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How Not To Get Myopia:
A Pilot Study of "Brisk" Students In Jerusalem

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OFFICIALLY: The Effects of Habitual, Short, Distance Viewing Breaks During Reading on the Advancement of Myopia In Reading Intensive, College-Age Men.

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KEY WORDS: Myopia, Prevention, Rest, Habits, Universities, Students, Reading, Books, Yeshiva, Jerusalem, Found Experiment, Surveys

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The Effect of Habitual, Short, Distance Viewing Breaks During Reading on the Advancement of Myopia in Reading Intensive, College-Age Men.

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ABSTRACT

Purpose: To determine, with a convenience sample in a pilot study, if habitual, short, intermittent Distance View-ing Breaks [DVB] curtails myopia in reading intensive, college-age students enough to justify a world-class analysis of such DVB & myopia.

Methods: A personal interview survey was conducted among college-age, Jerusalem students noted for their extremely reading intensive, low lecture time, low outdoor time program. They also combine high personal integrity with the world's highest published rate of High Myopia - 27.6% - among college-age men. The rate of Worsening of Myopia [WM] for myopes was determined. Those with and without WM were compared on amount of DVB during study periods.

Results: I. Myopes had a mean 2-eye average: -4.0±2.3D & WM: -0.32±0.25D/y. 4 of 19 myopes had High Myopia: avg: -7.56D. II. After adjusting for effects of unbalanced vision and myopia-free parents and siblings, mean log-weighted DVB times of those with and without WM were 3.4 & 71.9 sec/h, respectively. III. For the same two groups 2% and 77% were using DVB of ≥45 sec/h. P<0.0002 for both Comparison of Means and Comparison of Proportions for the two groups. IV. The Odds Ratio, [before adjusting for unbalanced vision and myopia free family] for ≥45 sec/h DVB: 10:4/2:17 = 21.25; 95%C.I.: 3.3 to 137.7; V. For 10 with no WM & DVB≥45sec/h, average length of each break =25sec.; mode: 60sec; range of avg. break: 1.75-120sec. VI. 4 of these 10 had mean break lengths of 2.5 to 25 sec/break. Mean for this 'short breaks' subgroup: 11.5sec/break. This is far less than what was found effective in animals. VII. If a causal relation exists, DVB≥45sec/h would be protecting ~10% of these students from WM. VIII. Similarly, for preventing WM, DVB≥45 sec/h appears to be ~10× more effective in terms of minutes/study hour than outdoor time and doesn't require leaving the classroom or breaking the study program. IX. Of 49 students approached, 44 cooperated fully, 3 partly. X. Except for their ideal of studying without breaks, almost all DVB behavior appears to have been spontaneous. XI. A key hypothesis leading to this pilot study: *'Students in such reading intensive Yeshiva programs who don't need glasses, practice DVB based on a tradition or recommendation'*- was not borne out.

Conclusion. This pilot study of college-age Yeshiva students found a combination of a very high background rate of WM & very strong association of ≥45sec/h DVB with no WM. XII. A 60-day study of 60 such students with WM of ≥0.6D/y, using available, precise [SD=20μ], non-contact, eye-length measuring methods, should produce world class causal results with a relatively modest budget. XIII. Such a study is urgently needed. If it confirms that such DVB actually curtails myopia, it would help stop 15k to 60k people [95%CI] from going blind globally [~$10 billion in lost human value] per month, in the coming decade. XIV. The study could involve students with similar or different curricula in multiple locales.

Acknowledgements. The author used free, public access computers of the National Library of Israel for nearly all research on prior work and for most report preparation. Free, online software was used for statistical analysis. This study rests on pioneering works of Francis Young, Josh Wallman and others cited in this report, together with the feedback of experts, friends and the time and cooperation of the students interviewed. The author funded this study from his own resources, conducted all interviews and has no conflicts of interest.

1.0 INTRODUCTION

1.1 THE PROBLEM OF MYOPIA is not just a matter of the cost and inconvenience of having to buy and wear glasses or contacts[1]. It brings with it a large increase in the likelihood of much more serious eye diseases- including glaucoma[2], cataract[3], retinal detachment[4] and presently incurable Visual Impairment [VI] and blindness from Myopic Macular Degeneration [MMD]. The last is a looming global plague threatening to take the sight of roughly 20 million people in the coming decades[5].

For any given person, the higher the level of myopia – the more nearsighted they are—the more likely they are to get these more serious conditions. [2-A, 3, 5] This means that it's not only important to prevent myopia in the first place - or cure it --but it's also important to stop it from getting worse and, if possible, reduce it. [6]

1.2 HISTORICAL INSIGHTS FROM ANIMALS: A major global effort is underway to discover how to prevent myopia and how to stop it from getting worse for those who already have it[7]. Among the more promising methods for prevention in both cases is taking breaks from near-work to focus on something distant. In 2002, leading researchers noted:

> "Consider a myopic child reading or engaged in other near-work for most of the day, thereby experiencing… [a stimulus that leads to increased myopia.] When the child looks up [to focus on distant objects] she would experience… [a stimulus that offsets the first stimulus.] These periods might have protective effects [preventing the development or increase of myopia] if they were not too brief or too infrequent."[8]

They note further:

> "In light of …[what] we have documented here [where a very small amount of distance viewing, offsets ≥50 times as much near-work] it is not astonishing that attempts to predict myopic progression in children by logging the number of hours per week that they spend at near-work have failed. Many epidemiological studies have shown a strong association between amount of education and myopia[9]… On the other hand, the correlations between the amount of time individual children spend reading or doing other near-work and the development of refractive errors have been very low…[10]

Though this work was based on studies of the rapidly growing eyes of hatchling chickens, the authors cite studies of similar processes at work in the eye growth of monkeys and other animals that are physiologically closer to human beings.[11]

1.3 RECENT STUDIES WITH STUDENTS: Five of six major research studies in three countries, involving a total of over thirteen thousand students, showed that taking "eye breaks" every 30 to 60 minutes was strongly associated with a reduction in the rate at which myopia developed in children and college stu-

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A. Teenage students in Singapore were willing to trade the equivalent of several years of their expected lifetime to be free of myopia. S-M Saw, et al, 2003, B. The out of pocket costs of myopia for glasses, contacts, visits to optometrists, surgical corrections of refractive error & specialized surgeries associated with pathological myopia – but not including time for doctor visits, lens maintenance or costs of special treatments for cataract & glaucoma that may result from myopia or special services to assist those who are blind from MMD, comes to $250+ per myope/yr. Ying-Feng Zheng, C. W. Pan, J. Chay, Tien Y. Wong, Eric Finkelstein, and Seang-Mei Saw 2013

[2] A. A.E.G. Haarman, et al.2020; Paul Mitchell, et al 1999 B. Mary Qiu, et al, 2013, C. Ling Shen, R. Melles, R. Metlapally, L. Barcellos, C. Schaefer, N. Risch, L. Herrinton, C. Wildsoet, E. Jorgenson 2016.

[3] C. Younan, et al , 2002, 2

[4] Jeffrey Cooper, and Andrei V. Tkatchenko, 2018

[5] T.R. Fricke , et al., 2018

[6] A. It may be possible to reverse myopia in children whose myopia is caused by excessive eye length: e.g.: 8y old boy with -2D myopia could grow out of it by 13 – if the rest of the eye grew normally – but didn't lengthen. If DVB prevented that lengthening, the child's myopia could be reversed. Based on 4 studies in Table 2, H.C. Fledelius, A.S. Christensen & C. Fledelius 2014: B. There's also evidence that in some cases eyes can shorten in response to suitable stimuli: Xiaoying Zhu, N.A. McBrien, E.L. Smith III, D. Troilo, Josh "Eyes in Various Species Can Shorten to Compensate for Myopic Defocus" Inv. Ophthal Vis Sci., '13;54:2634–44. See footnote 199

[7] At the 17th International Myopia Conference in Tokyo, 9/12-15/'19, there were 870 attendees with 72 presentations & 180 poster presentations. Prof. Padmaja Sankaridurg, quoting Dr. Ohno Matsui, President of the Japan Myopia Society.

[8] A. Cited 136 times up to Jun/1/'21: Jonathan Winawer, Josh Wallman, '02, "Temporal constraints on lens compensation in chicks", B. The subsequent J. Wallman & J. Winawer, 2004 review paper "Homeostasis of eye growth and the question of myopia", is cited 918 times [as of Jun/1/'21] "As a long-term senior faculty member of City University of New York, Josh Wallman pioneered the use of the avian model for understanding eye growth and made invaluable contributions to vision research and the field of myopia. There are likely no myopia researchers who have not read a paper from Josh Wallman's myopia research laboratory…" The 17th International Myopia Conference, Sept. 12-15, 2019, Tokyo Japan, Program p 38. Prof. Wallman's Lab received 62 grants from US National Institutes of Health and National Science Foundation 1985-2011-- with a cumulative total of over $10 million. http://grantome.com/search?q=@author%20%20Joshua%20Wallman

[9] Ibid, p 2667, They cite (e.g., Goldschmidt, 1968; Sperduto, Seigel, Roberts, & Rowland, 1983; Zylbermann, Landau, & Berson, '93; for reviews, see Ong & Ciuffreda, '97; Rosenfield & Gilmartin, '98; Zadnik & Mutti, '98)

[10] Ibid, p 2667, citing: Saw et al.,2000, '02; Zadnik, '97; Zadnik & Mutti, '98.

[11] Ibid, p 2667, citing work with, a. tree shrews, Siegwart & Norton, 1998; and b. macaques, Smith & Hung, 1999).

"I will lift up my eyes to the mountains ... אשא עיני אל-ההרים" [1]

STUDIES OF INTERMITTENT DISTANCE VIEWING [IDV]
OR NEAR-WORK BREAKS ON THE DEVELOPMENT OF MYOPIA

A.S. ADLER
PERSONAL READER PROJECT,
JERUSALEM, 28 TEVES, 5781
[JAN. 11,'21]

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REF/ YR/	REGION	SUBJECTS	TYPE OF BREAK	RESULTS	COMMENTS
12-I 2020	ISRAEL	27 'Brisk' Students	Distance Viewing Breaks [DVB] >45 sec/h	Comparisons of means & comparison of proportions; P<0.0002 "No Worsening M": OR(95 %CI) = 72.7; 95% CI: 4.3 to 1223	Myopes compared w emetropes on DVB during intensive, full day , select Chareidi Yeshiva study program. 27 excludes those w UV.
12-A 2019	CHINA	968 U. Stud.	Taking breaks after 30 min. continuous reading.	MA assoc. w myopia(OR= [1.64],95 %,CI= [1.08]-[2.44], P=.02 [inverted by ASA]	Those w no breaks after 30 min continuous reading were [1.64]×as likely to have myopia as those who did take such breaks
12-B 2018	CHINA	3,753 Child 10 -15 yrs	Rest of ≥5 min. after 30-45 minutes of Continuous NV	Those w breaks ≥5 min after >1hr have 2× likelihood of M comp. with ≥5 min after 30-45min Continuous NV [table	MA: Mean Odds Ratio, 95% C.I.. & 'P' >1hr=1.24; 1.14–1.32; <0.001 30-45min.=2.48;1.92–3.24; <0.001
12-C 2016	CHINA	4,129 Child. Grades 1-4	Not continuing NV for >30–40 minutes without an eye break.	MA: change in 'Refractive Error': t= -2.280, P= 0.023; p.12,table 5.[see table 6 for OR; see note C, below]	Includes 3 Questions: Continuing read & write/ watch TV/play with computer >30~40 min. without break. [See note C, below]
12-D 2015	CHINA	1,595 Child. G 7, 12.7y	Reading breaks of ≥5 minutes after >45 minutes,	Odds Ratio (95% CI) 1.40 (1.09, 1.80), P=.008; MA, Table 4, p. 8	Those w breaks ≥5 min. after >45 min. of continuous reading were 1.4X as likely to have M as those w breaks at ≤45 min.
12-E 2012	TAIWAN	694 Child. Grade 1-6.	Rest after 30-min. reading (never to always, 5 Rating	VA DV, r =0.630;p=0.000; SE: r=0.508; p=0.013, table 5, p 145	Use of different Rx for daily & near activities (never to always, 5 rating levels [VA DV])r=0.830,p=0.000;[SE]r=0.786;p=0.000
12-F 2008	AUSTRALIA	2,353 Child.	Breaks of ≥5 minutes for every ≤30 minutes of reading	Final MA model, OR of not having M (95% CI)1.5 (1.05–2.1)P=0.02;p.2908,table 5 [inverted by ASA]	'Defined as time spent in continuous reading before taking a break of 5 min. or longer on any given day.' Not clear. [Get questionnaire]
12-G 2002	USA	10 Young Chicks	20 sec DV every 20 minutes 42X/day, otherwise dark	Effect on vitreous depth ~1/2 'treated-untreated' for 2 min/2hr, 7X/day. Table 2, exper.4, p. 2656	Important nonlinearities & differences between vitreous depth & choroid thickness. Light :Dark change & chick handling issues

. ABBREVIATIONS : CI: Confidence Interval; DV: Distance Viewing; DVB: Distance Viewing Breaks G: Grade; I: Intermittent; M:Myopia; MA: Multivariate Analysis; NV: Near Viewing; OR: Odds Ratio; SE: Spherical Equivalent; UV: Unbalanced Vision; VA: Visual Acuity; w: with;
Verse continues: "From where does my help come?" Psalms 121:1, Bible.[205]

dents[12]. However, three of these studies – with a total of 7,701 students -- restricted their analysis to breaks of ≥5 minutes. This meant the associations, if any, of shorter Distance Viewing Breaks [DVB], would be put on the 'no breaks' side of the analysis, substantially diluting the results. Also, types of breaks in these three studies and in two of the other studies were otherwise not defined[13].

Only one of the 6 studies-- in Shanghai --clearly described 7 different types of eye breaks and examined some of the associations of each type. This large study, of young children[12-C] included types of breaks that specifically involved distance viewing: "Looking far into the distance" and "Taking turns to looking [sic] far & near into the distance". However the disaggregated results for these different types of eye breaks -or even the number of students using each type- weren't published.[14] As already noted in detail[12-C.ii], this study combined relatively distant and near viewing, obscuring the results of taking breaks from the latter[15-A].

1.4 MYOPIA IN YESHIVA: The problem of myopia is particularly acute among young men

[12] **I.** 44[27 in sub-study, Table, supra] Men, early 20's, select Chareidi Yeshivas, Jerusalem, A.S. Adler, "How Not To Get Myopia: A Pilot Study of 'Brisk' Students In Jerusalem" "No worsening myopia" includes "No myopia". see §6.2.ii.e &.f, p. 24 & more on Odds Ratio, p. 25.[This study, Nov/10/'20, Jerusalem]

A. 968 univ. students, 19.6±.9y, China, Luoming Huang, et al, 2019.

B. 3,753 Children, 10-15 yrs, China, Jin Tao Sun, et al, 2018

C.i. Combined "reading and writing" & "watching TV" & "playing with the computer" which are separate items in "Child Vision Care Behaviors Scale" Zuo Tan [now Dr. Hui Tan], et al, 2009 **C.ii.** Combining "watching TV"– done at much longer distances & more hours/week- with "reading and writing" & "playing with the computer", yields low OR for breaks after 30-40 min of this combination. Xiaofang You, Ling Wang, Hui Tan, Huij-ing Shi, et al, 2016.

D. 1,595 Children, Grade 7, 12.7y old, China, Shi-Ming Li, Anyang Childhood Eye Study Group, et al, 2015.

E. 694 Children, Grade 1-6, Taiwan, Hong-Ming Cheng, et al, 2012,

F. 2,353 Children, G7, 12.7 y old, Australia, Jenny M. Ip, Seang-Mei Saw, P. Mitchell, et al, 2008

G. See: Winawer & Wallman '02, p. 2656, Experiment 4, line 3, See Footnote 8. & TABLE, p 33. Exposing hatchling chicks to "distance viewing" for 20 seconds every 20 minutes, 14 hours/day for 3 days, caused vitreous depth in treated eye to grow 7±44µ, compared to 10±41µ for treatment 2 minutes every 2 hours 14 hours/day for 3 days. However, untreated eye's vitreous depth in 20/20 group grew only 106±22µ comp. to 202±16µ for untreated eye in 2/2 group. Choroid in 20/20 group changed by -50±21µ & -86±31µ in treated & untreated eyes, respectively; in 2/2 group, change was -27±8 & -18±17µ in treated & untreated eyes, respectively. Treated eyes had same change in vitreous depth in 20/20 & 2/2 groups but untreated eyes & choroid changed very differently, netting 0.2±0.8 & 0.1±0.6D change in refraction in treated & untreated in 20/20 group [=no change]; 4.0±0.7 & 0.3±0.4D in 2/2 group [=big change].

[13] A more recent study of 522 male high school students in Airforce educ. program [avg. age, end of 3y study=17.6y] found that a sub-group of 72 who "frequently" engaged in continuous reading or writing for intervals ≥1h did not have significantly higher rate of new cases of myopia than similar group of 69 who "seldom or never" engaged in such activity. But "frequently" ≠ usually or normally & may amount to only 1-3 episodes/week. Also, the meaning of continuous isn't clear – possibly incl., in respondents mind, short breaks to look out the window-- & type of break at end of interval isn't stated. The study also showed, contrary to the other studies cited, parental myopia wasn't associated with onset of myopia. It appears to show that having 1 or 2 parents who are myopic reduced likelihood that the student will become myopic—so, this was a very unusual group. This is further indicated by one of the criteria for inclusion: "uncorrected visual acuity ≥1.0 in both eyes and (2) SER between − 0.25 D and +2.00 D in both eyes." So, students who had a prior tendency to myopia were systematically excluded. This apparent contradiction was not noted in the discussion portion of the paper. Lin-song Qi, Corresp. author Zhi-kang Zou, et al; 2019

[14] The authors didn't respond to my request for more info. A 3rd type of eye break in this Shanghai study may also involve increased DVB: "doing out-door activities": running, climbing, swimming & calisthenics don't require DVB. Req. for info sent 2/20/18: Huijing Shi [corres. auth. hjshi@fudan.edu.cn] & Colleagues, Dept of Maternal & Child Health, School of Public Health, Key Laboratory of Public Health Safety, Ministry of Education, Fudan U., Shanghai; Req. also sent to Prof. Ling Wang, lingwang@fudan.edu.cn 2/27/18 [Thesis Tutor of Zuo Tan[now Dr. Hui Tan] & co-author of study] Dept. of Child and Adolescent Health, School of Public Health, Fudan U., Shanghai [no resp. as of 1-Jun-21]. Other types of breaks studied were: "Doing light physical movement"; "Doing eye exercises (Chinese eye acupuncture point mas-sage)"; "Taking eye breaks by sitting in repose with eyes closed" & "Looking at green plants".[The last may've once meant looking at outside greenery.]

in Chareidi[15-B] Yeshivas in Israel. Among 17-18 year olds in these schools who appeared for the compulsory military draft physical exam[16] 82.2% were myopic.[17] What's more remarkable is that 27.6% had "high myopia" [18] – defined in this paper as myopia of SEQ[19] -6.00 D or worse. This compares with 21.61% with high myopia among 19 year old male conscripts in Seoul, Korea[20]. The young Korean men in this latter study usually appear in lists as the group with the highest rate of myopia in the world[21]. This and other data[22,23] suggest that the High Myopia rate for young men in Chareidi Yeshivas may be the actual global record. Based on these and related numbers[24], the Global Orthodox Jewish Community alone – now less than 1/20th of 1% of the world's population – would be expected, *ceteris paribus*, to have an extra 20,000 people blind from MMD by 2050. About twice that would be expected to have Vision Impairment from MMD and similar numbers would be expected to develop cataract and glaucoma as a result of their myopia. Taking into account the published uncertainties noted in the most comprehensive global forecast, a total of on the order of 50,000 to 200,000 in the Orthodox Jewish Community are heading for seriously damaged vision related to myopia in the next three decades.[5]

1.5 PRECISION MEASUREMENTS: The last decades have seen great advances in the precision with which eyes can be measured. A change in the eyes equivalent to about 0.01mm or 1/40th of a diopter can now be determined with relatively modest cost[25]. This means that studies of hundreds or even thousands of students over a year or more- as with the studies cited above- are not necessary to determine the efficacy of a genuinely beneficial treatment. An experiment with 50 or fewer students running for only 2 or 3 months could accurately determine the effectiveness of a program expected to stop – or at least cut in half-- the progression of myopia.[191]

1.6 TAKING ACTION: When I saw that such a study could probably be done with relatively few students, at relatively low cost and in a short time, I brought this to the attention of some of the world's leading experts in the field. None appeared prepared to carry it out. Then I saw that those whose vision has declined to the point that they are defined as blind – with best corrected vision in the better eye of 20/200 or worse- are understood to have lost 1/3rd or more of their quality of life – comparable to a moderately severe stroke[26]. Though there are millions of people in

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[15-A] A more recent study by some of the same authors on the same general topic in Shanghai, notes "Section 3 considered whether the child took (i) breaks after continuous use of eyes for 30–40 min, (ii) if distance to books or digital tablets was less than 30 cm during reading or playing, (iii) if during distance viewing, distance to TV was less than 2 m and/or if distance to computer was less than 50 cm…" Xiangui He, Haidong Zou, et al, 2018.

[15-B] Chareidi means fervent – from a Hebrew word that means trembling – like the Quakers – who were known for their fervent religious observance. The not-so-religious call them "Ultra-Orthodox" – but this isn't a term the Chareidim – very carefully observant religious Jews -- apply to themselves.

[16] A large % of Chareidi Yeshiva students in Jerusalem come from outside of the country – mostly US &UK -& aren't subject to the draft. They include some of the most intensely studious young men in the Yeshiva World. Another significant fraction of Chereidi young men are from Israel but reject the government –& at a risk of being jailed, don't appear for the exam.

[17] **A.** Dana Bez, Hagai Levine, et al, 2019. If data for >2k myopic Yeshiva students 17-18y used in this study, includes dates of birth & test, it can be used to find rate of change of myopia by season or month. The original data source may have similar numbers of subjects ≥19y old. **B.** 81.3% of 14-18 years old in "Orthodox Schools" in 1993. R. Zylbermann, D. Landau, D. Berson, 1993 **C.** Students in this pilot study were overwhelmingly from US & UK . **D.** There was no significant myopia among sages of the Talmud [personal com. Rabbi Prof. H. Soloveitchik, N.L.I.]. They did most reading in daylight, discussions at other times & didn't use glasses [A.S.A.]

[18] Ibid, p 4 of 7 col 1, paragraph 2.

[19] SEQ = Spherical EQuivalent & takes into account astigmatism, counting each diopter of astigmatism as =0.5 D spherical with the same sign.

[20] Su-Kyung Jung, et al, 2012; High myopia is defined as > -5.99 D.

[21] A. This is not the result of large numbers of Korean young men having refractive surgery before they are 19, as the authors note: "For subjects who had received refractive surgery, we obtained data concerning the preoperative cycloplegic refractive error from the hospitals in which they received surgery." The study did exclude "persons who had surgery for retinal detachment such as vitrectomy, encircling, or buckling, as the refractive error may change." The number of such exclusions is not given. The number of 19 year old males is given as 23,616 normally resident in Seoul. The population of Seoul is around 10 million and accounts for about more than 1/5th of the country population. The number of 19 year olds in 2010 in Korea [28 year olds in 2019 population pyramid is 365,000 http://worldpopulationreview.com/countries/south-korea-population/]so it seems there's a relatively low number of 19y old males in Seoul in this study. B. 84.8% of 19y m&f Koreans: myopic;16.8%:HM; fastest rate of change:.46D/y from 7.5 & 9.1y, Seung Il Jung, et al, 2016

[22] Taiwan, HM male military conscripts 18-24y= 21.2%. Lee YY, Lo CT,Sheu SJ, Lin JL. 'What factors are associated with myopia in young adults? A survey study in Taiwan Military Conscripts' Invest Ophth. Vis Sci.'13;54(2):1026–33.

[23] A. Shanghai university students had a High Myopia rate of 19.5% (SE <–6.0D). Sun J, et al, 2012." Cited by: Saiko Matsumura, Cheng Ching-Yu, and Seang-Mei Saw, 2020 B. However, 19.5% was avg. of Freshman & 1st yr Masters students – with a combined avg. age of 20.2y & age range of 14.5 to 42.2y – among 5060 students in the classes of the university studied. For the 3625 Freshmen, with avg age of 18.8y, 94.9% were myopic , 18.12% (95% CI 16.9%–19.4%)were High Myopic. The avg. SEQ for the Freshmen was -3.97±2.40D; For the 1435 1st yr Masters students, avg. age was 23.8; 96.9% were myopic; 23% (95% CI 20.8%–25.2%) were High Myopic; age range 19.7 to 42.2; avg. SEQ-4.36±2.46D. Male & female students had similar numbers.

[24] There were an avg. of 213 new cases of MMD blindness registered in Israel each year from 1998 and 2003. Rahamim Avisar, et al, 2006. All cause Blindness prevalence in Israel in 2000=0.29%; Myopic Macular Degeneration[MMD] =.029%='Central Asia' in 2000, & 0.256% in 2050, [based on Fricke 5]; Orthodox Jews, 2×, for MMD =>.5%;Vision Impairment [VI] [incl. Blindness]>1.5%;+ Myopia augmented VI [including Blindness] from cataract & glaucoma- tho', unlike MM, these are treatable.

[25] The eyes lengthen ~1μ/day for each Diopter/yr increase in myopia.

[26] A. Melissa M. Brown, et al., 2003. B ., J. Wittenborn, D. Rein [National Opinion Research Center]2013.

the world who are completely blind[27] – and who have a subjectively good quality of life[28] - it made me think that doing something to prevent this suffering was very much like saving lives – millions of lives.[29A] In Torah Law, if we see another person in serious danger we should act to save them if we can.[29-B-E] So I stopped my regular work[30], took action and conducted this Pilot Study when I saw that no one else was prepared to do it.

2.0 PURPOSE

2.1 To determine, in a retrospective interview based survey, if taking intermittent Distance Viewing Breaks [DVB] is strongly associated with the curtailment of myopia in reading intensive college-age students.

2.2 If DVB appeared to be effective, this pilot study would prepare the groundwork for an experiment that would make precise measures of DVB effectiveness. This required determining the rate at which myopia is worsening in the group to be studied and the approximate fraction of students who have myopia worsening at a relatively high rate. The higher the rate at which the myopia is getting worse, the fewer days needed to make scientifically reliable measures of DVB based changes in that rate with a given small group of students.

3.0 HYPOTHESES

3.1 Taking breaks from intensive near work – such as book reading - of about one minute per hour - to focus at a distance, will prevent myopia or stop it from getting worse.

3.2 A substantial fraction of myopia-free students in a reading intensive Yeshiva program will be engaging in the behavior noted at 3.1.

3.3 A substantial fraction of these myopia-free Yeshiva students engaged in this behavior will have learned it either from their families[31] or

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[27] ~40 million blind worldwide in 2020 based on 20/400 or worse definition. R A Bourne, et, al, 2017.,

[28] "…consider the experience and opinion of blind people and their families that life is as sacred and meaningful to us as it is to any other human who has walked the earth and fretted about the day when he or she will walk no more." Gary Wunder, 2013

[29] A. 15k-60k people/m[CI 95%]are expected to go blind from MMD in 2021-31 [Fricke,'18,Fig 3B]. They're among the most highly educated & live ~20y blind. [based on Greene,'86] If their avg. income in those years ~$30k/y & blindness cuts quality of life~1/3, a measure of loss might be 20×$10k=$200k ea. or $3-12E9/m. Adding Vision Impairment less severe than blindness, total=$5-20E9/m. These people won't suddenly become blind: many millions are progressing slowly to the defined blindness threshold & 15k-60k are expected to cross it each month.

B. "If one person is able to save another and does not save him, he transgresses the commandment: (Lev. 19:16).

…neither shalt thou stand idly by the blood of thy neighbor …

… לֹא תַעֲמֹד עַל־דַּם רֵעֶךָ …

C. We also learn from Hillel –one of our great sages from two millenia ago: Perkei Avos 1:14

"…If not now, when? …ואם לא עכשיו, אימתי"

D. For those running Yeshivas, if they see their program could lead their students to blindness, they're obligated to establish protective measures that will tend to prevent such harm: Dt. 22:8:

"When you build a new house, then you shall make a protective railing for your roof"

"כִּי תִבְנֶה בַּיִת חָדָשׁ וְעָשִׂיתָ מַעֲקֶה לְגַגֶּךָ וְלֹא־תָשִׂים דָּמִים בְּבֵיתֶךָ כִּי־יִפֹּל הַנֹּפֵל מִמֶּנּוּ:"

E. There may also be a special mitzvah related to the blind: Lev.19:14:

"Thou shalt not – put a stumbling block before the blind… "

…וְלִפְנֵי עִוֵּר לֹא תִתֵּן מִכְשֹׁל…

In addition to the plain meaning, this may prohibit the righteous -*midos chasidos*- from imposing a study program without suitable breaks on themselves if it would lead to vision loss without glasses – or maybe even with them.

[30] I'm working on development of a new, 50gm, shirt-pocket size, biocular, virtual-image reading device – the Personal Reader™ [P.R.]. It's intended to expand the possibilities for reading in time, place & content for the general reader, older readers – who need much brighter light - and those who may be more likely to get myopia under normal reading conditions- as it can put the virtual page image at a distance of several meters or more. It's based on the use of a single, full color, pinky-nail-size electronic computer display – like those in the Epson Moverio BT-300. It's also good for mechanics – who can work with both hands free – and for religious Jews – who can use it to read microfiche on the Sabbath without violating its laws or spirit. With no space needed between the display and the face, it can be used to read in a sleeping bag or sardined in a rush hour subway. It can also be used to read in the dark without disturbing others who may be sleeping nearby. With extremely low power requirements, it's good for reading "off the grid". [A presentation was made on this work. A. S. Adler, 2017]

It was researching the myopia related market for this device that led me to see how large a problem myopia was today and how much bigger it is expected to become. [See Table, lines 8.1 &2, p 42, "PERSONAL READER INTUITIVE MARKET STUDY - ONE PAGE, NON-CONFIDENTIAL VERSION"] The key source on this looming epidemic was: B.A. Holden, et al, 2016. [see CONFLICTS OF INTEREST? §9.0]

[31] A. My grandmother told me – in 1955– when I was just starting to read by myself: ~"Lift up your eyes from the page every 15 minutes & look out the window. It's good for your eyes." She said it only once. When, in my late 50's, I still didn't need glasses for anything while my similarly reading intensive friends were usually myopic, I wondered whether it was following my grandmother's advice that made the difference – & where she got the idea. I began to research the question & quickly discovered the work of Prof. Francis Young on apes & recently literate indigenous peoples of Alaska. Dr. Young's work strongly suggested that it was the schooling process that was causing a rapid rise in myopia among these people. He was also able to produce myopia in apes by imposing school like patterns of hours of near-viewing on them. A. Francis A. Young, et al, 1969. B. Francis A. Young 1961

B. Then, years later, I found Prof. Josh Wallman's studies with chicks supporting the same idea – but also showing small amounts of distance viewing – like my grandmother's advice to look out the window – prevented myopia in these birds.[see p 45] I thought my grandmother – who read Russian, English, German, Yiddish & Hebrew—may've learned this from studies in the USSR that somewhat paralleled but preceded the work of Francis Young. But the work of both Prof. Young & the Russian scientists came long after my grandmother's advice to me in 1955.

C. So, I thought she may've learned it from her family – she came from a long line of studious rabbis. Many students in the Chareidi Yeshivas in Jerusalem – particularly the Yeshivas in this study – come from long lines of rabbis from the same part of the world: Eastern Europe. I imagined that many of those who didn't need glasses were taking intermittent DVB on advice from their rabbinical relatives. [But, if true, they'd share the idea & most would be practicing it. [Added 12/13/'20]

D. After completing most of this study, I found, in 1950, ½ of Ammassalik, Greenland was examined with cycloplegia (1,123 eyes): 0 had myopia ≥-1.5D, nothing on IDV breaks. Eric Skeller, 1954. [Footnote cont. on next p.]

from promotions such as that of Apple Ergonomics– which recommends the 20:20:20 rule for the amelioration of Computer Vision Syndrome.[32] [A 3rd option: that the students were taking suitable DVB spontaneously—the situation actually found– did not occur to me !]

4.0 METHODS

4.1 THE STUDENTS in this study were college-age young men – in their early twenties – learning in renowned Chareidi Yeshivas in Jerusalem. The majority were learning at the Brisk Yeshiva in the Zichron Moshe neighborhood. These students are known in the Orthodox Jewish community for their integrity, desire to do good, intellectual acumen and attention to detail. Their curriculum involves 8-10 hours - or more -per day- of reading and related near-work[33], five+ days per week and typically only three to five hours per week of lectures.

The students have a relatively uniform background of comparatively intensive study from an early age and spend much of their time reading similar texts – with multiple levels of footnotes and sidenotes that are often in very small print. They are known for their extensive knowledge and careful observance of Jewish Tra-dition, together with mostly Eastern European Jewish de-cent. Mostly raised in US, they're generally fluent in Hebrew, English and Aram-aic, and are a byword for punctuality and not wasting time.

STUDENTS SIMILAR TO - *BUT NOT INCLUDING* -THOSE INTERVIEWED, IN THE PLACE MOST USED FOR INTERVIEWS IN THIS STUDY. [PHOTO IS FROM ~4 YRS BEFORE] http://matzav.com/wp-content/uploads/2015/10/zichron-moshe.jpg

They're usually identifiable by appearance and found near their Yeshiva and the nearby Zichron Moshe Shul. Some interviewees were from the somewhat similar Mir Yeshiva- about a 15 minute walk away - though Mir students in their early 20's, study subjects in Jewish Tradition with more obvious practical value[34] than Brisk.[35]

On a typical study day during the school year, they spend very little time outdoors and their traditional broad-brimmed, black hats and dark suits shield their eyes, faces and bodies from much of the sun they'd otherwise be exposed to[36]. Eyeglasses and untanned faces are almost as much a part of the Brisk "uniform" as the hats and suits.[37]

4.2 APPROACH TO STUDENTS: Students were approached for a short, informal[38] interview during

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E. In 11/'20, I remembered my grandmother occasionally read Prevention, a periodical founded in 1950 by J. I. Rodale, who, in a Wikipedia photo, seems myopic. Lehigh Univ. Archive Specialists, Ilhan Citak & Andrew Stahlhut sent me from Lehigh's Rodale Archives all 8 articles in Prevention from '50 & '56 about glasses, eyes &/or vision. I read the 3 likely to contain something on IDV: I also searched the original ~340p book by W.H. Bates, MD, cited in 2 of the 3 articles, a related book by MacFadden & Bates and all 132 monthly issues of Bates' "Better Eyesight Magazine" 7/1919 -6/1930 with 134 hits on the word "window" & didn't found nothing like IDV. It may've been my grandmother's own idea. She taught me several other exercises—to strengthen ankles against sprains & eyes against strabismus; IDV would be against the strains of sustained reading at usual reading distance.

[32] A. Apple Inc. - advises: "Every 20 minutes, look 20 feet away for 20 seconds to refocus your eyes. You can also relax your eyes by looking at a distant object or closing your eyes for a brief period." They make no claim in connection with myopia. Apple Ergonomics [2021]

B. This 20:20:20 rule was originally promoted for amelioration of Computer Vision Syndrome by optometrist Jeffrey Anshel starting in the early'90's. As I discovered after I had completed most of this study, "…Dr. Anshel asserts that the Rule does not stop or reverse myopia development or progression." This is particularly remarkable as Dr. Anshel is quoted in the same article as noticing that one of the symptoms of intensive computer use by people in their late 30's was development of myopia. From "Deconstructing the 20-20-20 Rule for digital eye strain": Page 2 of 2, Brian Chou, 2018.

C. Maybe the study of the effects of simulated distance viewing of 20 sec every 20 min. [in Winawer, Wallman, 2002 [see footnote 8]] was stimulated by the promotion of the 20/20/20 rule.

D. However, I also discovered others who had been making such claims for years: Many of Prof. Young's papers, are on Donald S. Rehm's web-site, whose D-I-A-L method of healthy reading behavior includes: "I" "Interrupt the close work by looking into the distance momentarily at the end of each paragraph, or at least at the end of each page, to relax the eyes." In addition to maintaining a good Distance, Angle of the page to the reader's line of sight & Lighting. Donald S. Rehm, 2005 [& '20]

E. 1. Alejandro Fernández-Montero, et al, 2015,. Shows increased computer use in adulthood correlates with increased myopia in adulthood. 2. [Frequency and incidence of myopia among medical students[in Polish]] Katarzyna Mozolewska-Piotrowska , et al, 2005. Myopia developed in 13% of initially emmetropic students.

F. I still don't know where my grandmother got her idea. My eyes are very unbalanced [UV] & operated on for strabismus when I was four. After seeing the results of this pilot study, it's much more likely that my UV saved me from myopia than the suggestion of my grandmother-- which I don't remember applying in any systematic way.

[33] The related near-work is "learning with a chevrusah (study partner)". It involves studying texts either face to face or side by side - each with a book in front of them. Their faces are ≤ 3/4 of a meter apart -and usually less.

[34] The main benefit of this study and the prayer that goes with it is "to come closer to God" both in one's sense of the world and in one's behavior. This comes from coming close to Torah and its sages who, in their thinking and behavior, exemplified this closeness. A secondary effect is that it sharpens the mind for understanding complex, detailed issues with often unexpected, ingenious or seemingly contradictory solutions. Still another effect is that it prepares the young man to appreciate diverse opinions and to be effective in navigating the complexities of the real world. The graduates of these schools are also sought after by the similarly oriented families of young women looking for suitable husbands.

[35] See map of area, page 34

[36] There is some evidence that increased outdoor time and exposure to the sun reduces the development of myopia. The studies cited above on taking breaks from near work also studied the effects of out-door time. [See table, p 28] However, it also appears that short, well timed DVB have the potential to have an even greater effect with an order of magnitude less time away from studies. In fact, the breaks don't have to be away from studies at all, as special posters with learning material can be put up on the walls. In more conventional schools and libraries , electronic screens could be used to provide interesting, relevant and varied materials geared to the needs of the readers.

[37] With all this, they're generally in good physical shape—from walking quickly, running up stairs & dancing at weddings. They dance for the mitzvah of adding joy to the newlyweds. The custom here is everyone is invited & in some months, students dance at several weddings/week.

[38] An informal method was chosen as it was felt that asking school leaders for permission to interview the students without having any recognized expertise or proof that the students were actually taking any such breaks would have probably resulted in refusal of permission. Further, in these schools there may be a cultural bias against taking any breaks. Having habits of learning for hours at a time without a break is considered laudable. [See footnote 56 on retzifus learning.]

the regular school term[39] at times and places where they would not be expected to be studying and where they'd generally be wearing their glasses for distance vision. The most common place where they were approached was outside of the above mentioned Zichron Moshe Shul, not too long after the end of the Sabbath – about an hour or so after sunset on Saturday nights.

4.3 NO GLASSES GROUP. The first students to be interviewed were those who, at the above time and place, were not wearing glasses[40]. An attempt was made to interview every such student seen. They were approached with a comment such as: "I notice that you're not wearing glasses." It probably helped here that I am from the neighborhood and, except for my gray beard and the absence of the traditional black hat, I don't look too different from the students themselves.

Since I only intended to ask them about breaks and wanted to maintain a sense of informality, I initially did not even have a notebook to write down the information. Instead, I relied on my memory and jotted down what I remembered after the interview. After the first group of interviews, I used a small, shirt-pocket-sized, hardcover – but unprofessional looking – notebook, and only took it out of my pocket when the student agreed to be interviewed. I thought that the more informal the appearance of the interview, the more likely the students would cooperate. I explained what I was doing to any student who asked[41] and generally didn't even ask the student's first name[42].

4.4 INITIAL MISTAKES In the first group of 9 interview attempts with students who were seen not wearing glasses, I discontinued interviews with three students who volunteered at the outset that they had some form of Unbalanced Vision [UV]. I had seen that several large studies of myopia in students had excluded those who had such issues.[43] After this, I realized that UV may be a factor that protects students from myopia and made a point of asking about it. The result of this was that among these first 9 attempts, 3 who were asked about breaks were not asked about UV[44] and 3 who volunteered that they had UV were not also asked about breaks.

4.5 GLASSES GROUP After the first 18 approaches to students who were not wearing glasses, I attempted to interview those with glasses in the same general settings of time and place. With these students, I had my notebook in hand and after the first dozen, prepared a form in the book to make it easier to record the information quickly and accurately. They're generally very careful not to waste time and I made an effort to speed things up by maintaining eye contact while writing what they said in my note book. This resulted in interviews that typically ran just a few minutes and a very high level of student cooperation. The downside was that some words in my notes were illegible[45] and some of the responses turned out, in retrospect, to be ambiguous.

4.6 RESPONSE RATE: Of 49 approaches to interview students- 26 not wearing glasses and 23 with glasses – 44 answered all questions asked. Of 5 who didn't cooperate fully, only 2 completely refused to be interviewed – both of them wearing glasses. The 3 partial cooperators were all among those not wearing glasses and will be discussed further in the results section. Of 44 who answered all questions, 3 were self- selected. [46]

4.7 CONFIDENTIALITY & ETHICAL ISSUES: There were altogether only 6 of those interviewed where I asked for a first name – 5 who didn't wear glasses and 1 with glasses - and all cooperated on this question. Their names were requested because their responses were unusual in some important respect and I thought that further contact might be helpful in either clarifying their responses or for more substantive research. A few others gave their names more informally. These names won't be published without receiving the explicit consent of each student concerned. [47], [48]

[39] Limiting interviews to the school term was intended to help get a more representative sample of the students—as a large fraction leave the area – or even return to their parent's home in the US -- during school breaks. Some use these breaks to go on hikes or other outdoor activities – which would mean those who stayed in the area during these breaks would not be as representative as far as outdoor activity is concerned.

[40] They were interviewed first because if significant numbers did not have DVB there would have been no point in interviewing those with glasses.

[41] At one point during the second stage of interviews – when I was collecting detailed information from students who were wearing glasses- I found myself giving a talk on myopia and its possible causes and effects to a group of about ten students out on the street by the Zichron Moshe Shul.

[42] In 6 interviews where the student's response was very remarkable in some way, I did ask the student's first name with a view that if further information were sought, it would be more likely I'd find the student again.

[43] Studies listed at footnote 12 including study A where those with amblyopia were excluded; study C where those with "obvious strabismus" were excluded; and study D where those with "amblyopia, strabismus or any other conditions that might affect the analysis" were excluded;

[44] Student A-5 was found & re-interviewed on UV & possible relationship with student A-2 who had same pattern of DVB & general appearance.

[45] See page 11 for an example. I do little handwriting & I didn't realize how much it had deteriorated. My hands also appear to be less steady than they were just a few years ago. When I relied on memory alone, I wrote what I'd heard as soon as I finished the interview. With the interviews of students with glasses – which involved the additional need to record 2 sets of prescriptions & the time between them, I wrote the info. while talking with the students & didn't read what I'd written until later – when I'd collected a substantial number of responses. Starting with B-13, I made up an interview form which saved time & improved clarity.

[46] These 3, A-19, B-20 & B-24 asked to be interviewed. B-20, at 26, turned out to be outside the early 20's target age range & will be included only in a supplementary analysis. A-19, was at a time of day & place where I interviewed those with & without glasses & was otherwise avg. It isn't clear if he was asked about UV. B-24 contributed important info. but may over-represent his characteristics in the "wears-eyeglasses" group.

[47] Since I only asked for the student's 1st name, in most instances when I asked, that's all they gave. In one instance the student gave his full name & as a result, I was able to confirm something important about his responses.

[47] A. It's usual in a study of this sort to include a declaration like: "This study was approved by the Human Ethics Committee of University X and was carried out according to the tenets of the Declaration of Helsinki". I am not

affiliated with any university & didn't attend any as a formal student. This study was conducted by the ethical standards of the religious [Orthodox] Jewish community of Jerusalem. The key Ethics Committee person was Rabbi Prof. Yitzchok Breitowitz, Rav of Kehillos Ohr Somayach, a specialist in Jewish Law & Medical Ethics, magna cum laude Harvard Law School, '79. Author, e.g.: "Halakhic Approaches to the Resolution of Disputes Concerning the Disposition of Pre-embryos" 1996.

B. The Declaration of Helsinki is a product of the World Medical Association (WMA), an organization representing physicians. They note on their web-site: "The organization was created to ensure the independence of physicians, and to work for the highest possible standards of ethical behaviour and care by physicians, at all times." https://www.wma.net/who-we-are/about-us/ It further sates "WMA's core mission is to promote health and the well-being of physicians and patients..." https://www.wma.net/who-we-are/alliance-and-partner/official-relationship/ They put physicians' well-being before patients.

C. What's more important is that almost all medical schools associated with the WMA use human bodies for dissection in anatomy education. The member organizations of the WMA tell the public in their respective countries that it's a noble thing to donate one's body for this. They don't tell the public that if even 5% of MD's donated their own bodies or the bodies of their spouses or parents, they wouldn't need donations from others.

D. They also don't tell the public that the leading board that accredits medical schools in North America – the Liaison Committee for Medical Education [LCME]—does not require a medical school to provide any contact with a cadaver in anatomy education. This has been true now for over 4 decades. [Personal communication with Robert Eaglen, Associate V. P. LCME, Medical School Standards and Assessments. 3/15/'01. He was confident that there was no requirement before 1980, but couldn't say how much before without doing some time-consuming research.]

E. To have bodies for these unnecessary cadaver dissections in medical schools, they've taken bodies of the friendless & destitute – largely against their will - since the UK Anatomy Act of 1832. In any ordinary ethical system, this predation on the bodies of the friendless poor by the relatively wealthy community of physicians, would be called "Social Cannibalism".

F. The organizations of physicians in almost every country know the names of the personal physicians of every legislator and have substantially more influence upon the law makers than the friendless and destitute dead.

G. There is also extreme hypocrisy: A 2009 survey of Dutch anatomists revealed: "... none of the survey participants [n=54] are registered as a whole-body donor and that only a quarter of them would consider the possibility of body donation." S. Bolt, et al, 2012

H. In Israel, the organization of non-religious physicians had laws passed that gave them rights to do head-to-toe autopsies on everyone who dies – against the wishes of the deceased or their family members – and for no immediate legal or medical purpose. This program was to study the relative importance of heredity & environment in the development of hardening of the arteries. It was funded by USA – where forced autopsies for such purposes were illegal -- pursuant to an interest in this question by the WHO.

I. 1st known decision in Jewish Law on use of human cadavers in medical educ. is from R. Yaakov Emden(1697 –1776), in 1737 in response to a question from Jewish medical student, Benjamin Wolff Gintzburger, at U. of Gottingen, Germ. "Jacob Emden declares that dissection of both Jewish and non-Jewish cadavers is prohibited because it is forbidden to derive benefit from a corpse. [As reported by R. J.D. Bleich, Pt. I, Ch. 3, Medical Questions, Study of Anatomy II: Observation, 26, "Contemporary Halakhic Problems" V2, 1983] Responsa. Part I, no. 41.[p. 35, side a, 1st par., right col. has key point, as noted by R. Yitzchak Breitowitz, personal com. 2/24/'21] R. Emden was counted among the greatest rabbis of his time & a particular favorite of one of my key Torah teachers, Rabbi [Prof.] Shlomo Zvi Sternberg, שליט"א .

J. SOME REFERENCES ON THIS ISSUE INCLUDE:

a. "Compulsory Post-Mortem Operations in Israel" Committee for Safeguarding Human Dignity, ~40p. Plus cover letter. '66, 13 Straus St., Jerusalem & rm. 315, 15 Park Row, NY, NY. 10038. A key figure in this committee was Rabbi Rephoel Soloveitchik of Yerushalayim. His campaign against forced autopsies is detailed in:, B.C. Glaberson, '99

b. Charles S. Liebman, 1977 "Public Committee for [the defense of]/[Safeguarding] Human Dignity" R. Yeddiya Weiner, Talmud muvak of Chazon Ish, secretary of Committee. Threatened 10,000 Yeshivalite in Kikar Shabbat if accident victim's body is not released by OCME Israel.

c. Meyer Birnbaum with Yonason Rosenblum, '93. Gives example of study conducted at Hadassah Hospital in 1959-60 of atherosclerosis in 895 autopsied patients. Anti-autopsy campaign, with Lt. Birnbaum photographing bodies of those who received unnecessary autopsies, began in summer of '66, when "the rate of autopsies in Israel was spiraling rapidly, and had reached 80% in most of the major hospitals." p. 220 "At a mass rally on September 20, 1967, Rabbi Moshe Feinstein [said he would put a ban] on Jews living or traveling to Israel unless the Pathology Law was repealed." p.225

d. Rabbi Moshe Sherer cut down unnecessary autopsies in Israel by ending the funding of research based on involuntary autopsies by the U.S. Dept. of HEW, NIH – by mid '73. Yonason Rosenblum, '09.

e. Rabbi Yehudah Dick ,1967; Menachem Greenberg, 1967

K. In addition to WMA's apparent approval of use of bodies of friendless & destitute in anatomy educ., one of its key members – the A.M.A. – is responsible for preventing MD's immigrating to the US from working as MD's unless they pass the medical exam in English. This meant highly qualified older MD's emigrating to the US from the USSR/FSU couldn't legally work as MDs in family practice or in general hospitals – where they could be of great value serving those who spoke their language – but not English.

4.8 PRESENTATION OF DATA: Two annotated tables were prepared with the collected data, listing the results of each interview in the order in which they occurred. [see Tables A & B, p 35-36]. In addition to the valuable data collected, the tables include indications of the ambiguous responses and illegible words noted above.

Two bar charts were prepared: Fig.1[p.37, top] with separate groupings for those with and without glasses showing intermittent distance viewing time/hr and average length of each distance viewing break for each student supplying such data. Fig.2[p.37, bottom] shows the average current prescription for those wearing glasses or contacts and the rate of change/yr for those who had such data. Fig. 2 is aligned with fig.1 so that it is easy to connect the two sets of data with a particular student. These figures also show if the student had UV and if their rate of change of myopia in the past year or DVB break data involved some estimation on my part. On p.38 is a scatter plot showing rate of change of prescription in Diopters/yr. vs. DVB [sec/h] and an exponential regression curve.

The statistical analysis and calculations- including standard deviations, P values for "comparison of proportions" and "comparison of means", Odds Ratios and number of students needed for a given level of reliability in an experiment-- were carried out with readily available, free, online programs.

5.0 RESULTS

5.1 DISTANCE VIEWING BREAKS

5.1.a NO GLASSES GROUP: Of the 26 students approached who were not wearing glasses, none completely refused to be interviewed. Three, however, refused to answer some key questions. Two of these said they did not use or need glasses or contacts and didn't have surgery to correct the refraction of their eyes. But they said they were in a rush and just did not have the time for further questions. These were the 3rd and 4th students approached – they were actually together at the time – and reinforced my sense that I'd have to keep the interviews to a few minutes or less.

One – the next to the last interview in this group--cooperated in answering questions about UV – that he had none -- and about family members need for glasses – none had or needed glasses. But then he refused to answer questions about breaks, giving the sense that he did not want any more questions. However, after this, he gave his first name and the city he came from.

In the first three completed interviews, I didn't ask about issues of unbalanced vision -UV– limiting my questions to Distance Viewing Breaks –DVB- during study periods. Still, 2 of these 3 were extremely remarkable: 2 different students with very similar appearance and build, gave exactly the same unusual answer – that they were taking breaks of 2 or 3 seconds every 2 or 3 minutes. This is shorter and more frequent than anything I imagined – and according to the studies of Winewar and Wallman[8] should probably not be effective. The interviews were a week apart and at points about 300 meters distant from each other. I asked the 2nd of these two for his name and followed up to see that they were not identical twins or brothers[49]. Of the next 6 approached, one was actually myopic and two others were wearing contacts. The other three all volunteered that they had various forms of UV and were covered in section 4.3: INITIAL MISTAKES.

Of the remaining 15 approaches, 2 more wore contacts and two [A-7,17] were myopes who did not like wearing glasses or contacts. Student A-7 said that he didn't need or wear glasses but did not say that he could see clearly at a distance –so I asked him if he could read some small print on a distant building – print that I could read easily. When he tried, he couldn't. Thereafter, if the answer to the question of needing glasses seemed ambiguous or hesitant, I asked the student to read some distant small print or the like.

A-17 had -1.0D myopia -or worse- and took unusual breaks. Instead of looking up from the page – he said that he would defocus his eyes and "look through the page" – "spacing out" as he put it, for 2 or 3 seconds every 3 minutes. Since he is not focusing on anything, the effect is not the same as focusing on a distant object in terms of its ability to signal the eye-growth mechanism. It would also not be obvious to observers that he is taking any kind of breaks at all. His break pattern was very similar in timing to the pattern of the two look-alikes— though he did not look much like them -- supporting a distinct inherited tendency.

When I asked him if he used or needed glasses or contacts, he told me that, the year before, he had just passed his vision test for a driver's license. I tested him as I had with student A-7 and he failed.[50] The vision test for a driver's license requires 20:40 or better. For a person who has good near vision without glasses, distance vision of 20:40 is the equivalent of -1.0D—which is myopic.

This is a good place to indicate that all information about the vision of the students and their prescriptions for eyeglasses, if any, was as reported from memory by them. The exception was this question of whether they had good distance vision.

5.1.a.i In sum: of 26 students approached who were not wearing glasses at a time when they'd be expected to wear them if they needed them:

14 who were not myopic gave useful DVB info.
4 gave useful UV info – but no DVB info.[51-A]
2 didn't need glasses but gave no DVB or UV info.
4 wore contact lenses
2 were myopic
26 Total approached students not wearing glasses.

11 of 14 with DVB data also gave clear UV info.
1 more of 14 with DVB data,A-19,probably had no UV.
1 more of those with DVB but no UV data, A-2, may be findable based on a photo of A5 – who upon re-interview 11/17/19 said he had no UV and had no cousin who looked like him.

5.1.a.ii Of the 14 with DVB data & No Myopia:

SECONDS OF DVB PER HOUR

0 3 said they didn't look at the clock or anything distant for even one second in the course of a typical hour of studying.

One of these, student A-13, noted that he studied continuously on his own for 3 or 4 hours in the morning program without taking a break of even one second to lift up his eyes from the page. He said both eyes were good for near and far [apparently No UV] and neither of his parents and none of his siblings had or needed glasses – but some of his cousins did. We both saw how unusual this was[51-B] and when I asked for his first name, he gave it readily. I interviewed him while we both walked quickly several hundred meters - as he was rushing to catch a plane. [I've noted that he has no apparent UV: It may be that some have eyes that are good for near & far but don't work together, so they can't see stereo & this may be a protection from myopia.] He's the only one in this study I've counted as"Myopia Free Family" [MF].

Another [#A18] had one parent with extreme myopia and the other without glasses or need for them. He had a very large number of adult

[49] I was able to determine they weren't the same person or twins or brothers. Two months later, I re-interviewed #A-5 [Date removed pursuant to medRxiv screener's request. See text box, p.17]. He said that he had no UV & didn't know of any cousin that looks like him.

[50] At the time, I was 67.5 years old & saw clearly at distance in-doors or out & read fine print in direct sunlight with the same eye.

[51] A Students A-6,8,9 & 25. B. Assume, e.g. ≥2 brothers & 2 sisters ±5y of his age] [Avg. Chareidi woman in Israel has ~7 children in their lifetime. A. Hleihel, 2017; Similar in USA] & M & F are 80% & 40% myopic, [Zylbermann, '93] then, incl A-13 & parents: $1/[.2^4 \times .6^3]=1:2,894$.

siblings and said that most of them did not need glasses. He also said he had **[no UV].** I asked him if he could see the minute marks on a distant wall clock and he hesitated for about 3 seconds before saying yes. It was not clear to me if this 3 sec. delay was because he had difficulty seeing the marks—which I could see clearly- or if he didn't immediately understand what I was asking. [Since the question was unusual, the latter is more likely.] As he was in a rush and appeared reluctant to answer any more questions, I just asked for his first name – which he gave.

A 3rd student [#A14] had one eye good for reading and the other good for driving [has **UV**]. He has 3 brothers, 11, 14 and 19 – none needing glasses.

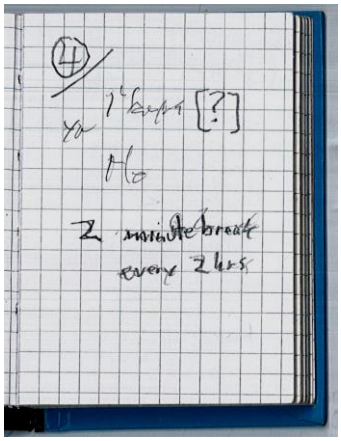
10-30 1 [A-22] said he usually increased his DVB time in the AM from ~10 sec/h in the 1st h to 20 in the 2nd & 30 in the 3rd . I used the average, 20sec/h in the basic group calculations. He said it was difficult to estimate. He had **[no UV]** and said he "looked around the Bes Midrash and at the clock."

The interview was cut short when his bus came. It wasn't clear whether this DVB was in the form of a single break/hr of the stated duration or if it was broken into several shorter segments. I used the median and mode of number of breaks per hour to assign him 2/hour of 10 seconds each. This puts him in the group with DVB of less than 25 sec/h.

Among students with glasses in this study that could provide data on the change in their prescription in the past year, all 13 of those with less than 25 sec of DVB per hour and no UV, have myopia that is getting worse[52]. This suggests that the DVB of this student may not be the reason he has no myopia – but that, without UV, he may actually be protected by something like the same factor that is protecting student #A13. I did not have time to ask him about his parents and siblings. because, as already noted, the interview was cut short when his bus came.

>30<60 There were no students with or without glasses whose avg. DVB was in this range. But see §7.4.E.

60 4 students said they were taking breaks that came to 60sec/h – though with 3 different patterns of break length and interval. None said explicitly that they were taking a break of 1 min./h – though this was the result of taking the average of their typical break length and average of the number of breaks/h. In one case, [A-19] it wasn't clear in retrospect, if he was taking a 2 minute break every 2 hours or the sum of all his DVB beaks in 2 hours was 2 minutes. He asked to be interviewed as I was interviewing another student who was wearing glasses and began to be surrounded by other students who wanted to learn about myopia. His interview record had the word 'No'- apparently referring to all questions he could've answered 'Yes' to. [See ~1/2 size copy, right.] Since I discussed UV with the students he was with, I'm ≥95% confident he did not have UV.



Sixty sec/h is also the median and mode of the group of those 14 non-myopes with DVB data. It is also the most effective dose of distance viewing in studies with young chickens. 2 minutes every 2 hours was 30× as effective per minute of distance viewing as distance viewing all day. It was also twice as effective as 2 minutes per hour[53].

On the other hand, in this same series of studies with young chickens, when the DVB time per hour was held at 60 seconds – but instead of 2 minutes in two hours it was 20 seconds every 20 minutes or 2 seconds every 2 minutes, there was no significant change in the focusing power of the chick's eyes[54]. However, the authors note that the experimental method may have disrupted the usual growth process. They point out that the lights were turned out between episodes of forced distance viewing and the dark/light/dark adaption process may have disrupted normal growth[55]. The chicks were also handled – to apply and remove the velcro mounted contact lens used to simulate distance viewing – at 2 or 20 second intervals – and this may have further upset normal growth. These factors were not relevant to the growth of the eyes of the students in this study.

>60-<180 None with breaks this range. But see §7.4.E.

180-360 There are 6 students in this grouping - which includes the highest amounts of DVB of any students in this study. None of the DVB of the 14 students reported here would have been counted in the 3 prior, large scale studies that asked about eye beaks of ≥5 minutes every 30-45 minutes. Instead of being on the side of showing breaks are apparently effective, all of this DVB would've been on the side showing DVB is apparently not effective! 12-B, D, F

Student A-20 -- with 3 minutes DVB per hour - was embarrassed to tell me how much time he is taking for DVB in front of other students – so he moved the interview dozens of meters away from where we started and told me of his 3 minutes an hour DVB. He said that he is trying to reduce it. Perhaps for similar reasons, Student A-25 would not talk about breaks at all. This suggests that overall reporting of breaks of any kind will understate the reality somewhat[56] – but there is no

[52] The best single estimate for 2 more of the students with myopia [B-7,17] was 20sec/h DVB. However, because of ambiguity in their answers, allowance was made for higher & lower values & the weighted avg. of these -30sec/h -was used in place of single best value. See footnote 64 for weights & §§ 6.2.i.g-h &6.2.ii , probabilistic & extreme value weighting, resp.

[53] Winawer & Wallman, 2002, Table 2, a version of this is on p 34, infra.

[54] Ibid, experiments 2, 3 & 4 and Fig 6

[55] Ibid , p 2664, section 4.3, last paragraph.

[56] Pressure on students to learn retzifus- -- without breaks or interruptions. [See note on this page 27, Discussion, 7.2.c] The following says

reason to believe that those wearing glasses for myopia will understate it more than those who do not need or wear such glasses.

At the same time, this concern about taking breaks may have made the students more aware of the breaks that they actually were taking – making their reports of break time more reliable than those of students in other environments who may not be as focused on how they are using their study time.

Student A-23, with twice as much DVB and tied for the highest of all the students with two others, also said he's trying to reduce it. Student A-12 said—in front of his friends -- half of his time is spent looking around the Bes Midrash – but only ~1/5th of that is actually focusing on distant people or things – giving him 360 sec/hr.

To the extent that DVB in these students works similarly to what was found with chicks[8], it's very likely that their 2 to 5 minutes of DVB time above 1 minute/hr are of little benefit in limiting myopia. In the studies with chickens, doubling the dose from 2 min./2 h, 7× a day to 2 min./h, 14× a day, had no additional effect on the pattern of eye growth. Increasing the dose by a factor of 60 – so the chicken was forced to "look at a distance" continuously for 14h/day, doubled the effect on eye growth. [However, see student B-24, below]

5.1.b GLASSES OR CONTACTS GROUP:

Of 23[57] students approached who were wearing glasses or known in advance to be wearing contact lenses, 2 completely refused to be interviewed. All others tried to answer all questions asked.

Of the remaining 21 who answered all questions:

B20 was excluded from the rest of the main analysis because, at 26, he was substantially older than the other students. He is included in supplementary calculations. See § 6.2.ii

B9 has missing DVB data[169] – possibly because this information is found in 3+ illegible words.

B15 has what appears to be DVB data, but in retrospect, it seemed [80% intuitive likelihood] he was looking at his phone, not DVB. A single value of 6 sec/h DVB is used in the main analysis [6.1] and both 0 & 30 sec/h are used in probability calculations. See 6.2.i.i

5.1.b.i This left 19 with usable DVB data.

However, of these 19, the responses of the first 5 students interviewed in this group all have zero DVB. This is unlikely by chance [5/5:7/19 P= 0.0139 [58]] & suggests a possible problem with my interview technique[59]. B-1, B-2 & B-6 only say "no breaks" but B-3 says: "No breaks. Doesn't look around the Bes Midrash". B-5 wore contacts & took frequent non-DVB for tearing eyes. B-4 – not wearing or needing glasses- asked to be interviewed as I interviewed B-3, amid students who wanted to learn more about my research & wore glasses. [B-4 was transferred to "No glasses group" & became A-19].

A closer look at the rest of the DVB data for the 19 shows that there are 4 more with ≤4 and >0 sec/h. If we add these 4 to the 7 with 0 DVB, we get 5/5: 11/19 and P = 0.0819 -- this is usually considered "not significant". If we extend this to the level of 10sec/h[60], we have 5/5:13/19 and P = 0.1555. If we add to this that student B-5 answered in detail, explaining that he takes multiple non-distance viewing breaks – but no DVB and that B3 said explicitly that he does not look around the Bes Midrash, the problem of the string of 5 zero's is further reduced. The data for B-1 shows that he said that he "never takes breaks"—with an emphasis suggesting it was a matter of deliberate policy &/or that he was very conscious of this special behavior. He also added substantial details on what he was told for eye health – in response to my questions on this. He was not in a rush and was glad to answer all of my questions.

This suggests that if I'd pressed these students by asking them specifically if they took breaks for even a second or so to look at the clock or Rosh Yeshiva every 15 to 20min, I'd probably have added only a few seconds to the group average for the 5 with zero DVB – but not much more[61].

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that it was "Adapted from Rav Nissan Kaplan's Kesher Shel Kayama" http://dafyomireview.com/rebnissan/Kesher_Shel_Kayama/062-2012-Behaloscha-English.pdf

..."The Chazon Ish writes that one who learns with interruptions, his learning is hot air, meaning to say he will not even receive ...[reward] for the short time that he actually learns. ... Rav Chaim Shmuelevitz, zt"l, in his Sichos Mussar (Achrei Mos, 5731 and Shoftim 5731) ...[wrote] We think in terms of mathematics, that 12 years plus 12 years equals 24 years. That, says Rav Chaim, is not the case by *limud HaTorah*. In fact, the continuity of 24 years is not the same as two sets of 12 years with a break in between. https://letstalktorah.weebly.com/chumash---chassidus---hashkafah

"The definition of a *masmid* is not someone who learns until he collapses, but someone who learns when he is supposed to, davens when he is supposed to, eats when he is supposed to, and rests when he is supposed to!" ~ The Netziv from Torah Tavlin, https://emunadaily.com/2011/11/02/who-is-a-masmid/

[57] There are 24 approaches to students listed in Table B The WEAR GLASSES OR CONTACTS group. One of the students - #4 – did not wear or need glasses or contacts and asked to be interviewed amid a group of those who did. He was transferred to the no glasses group, where he is #19.

[58] Calculated at : https://www.medcalc.org/calc/comparison_of_proportions.php

[59] B-15 is assumed here to have 0 sec/h DVB – the best single estimate. See paragraph immediately above.

[60] As with B-15, this is based on the 10sec/h DVB best single estimated values for 2 students , B-1- & B-12. The probability weighted value of 15sec/h DVB – taking into account both higher and lower possible values – is used in the main analysis and is shown on the bar chart on page 37 .

[61] [This issue of inadequate interview technique is important – and I hope to address it more thoroughly in the discussion part of this paper [A. Clever Hans type issues , B. failure to ask about earlier behavior of myopes that had high DVB in past year – along with zero change in prescription and C. whether the myopes usually read with or without their glasses. [The higher the myopia the more likely they read with their glasses particularly in the High Myopia range.] A myope reading without his glasses would have much

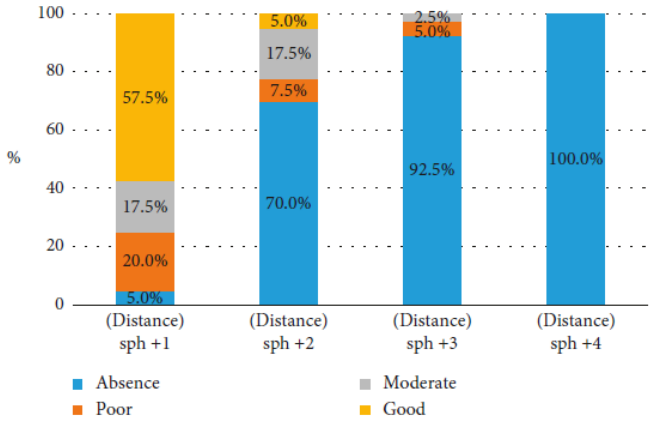


FIGURE 4: Distribution of patients with different grades of stereopsis at distance according to the level of spherical myopic anisometropia presented on the graph.

OPEN ACCESS ARTICLE: NO PERMISSION REQUIRED

5.1.b.ii Details of 19 with usable DVB data.

0-<10sec/h One student is particularly interesting in this Group: B14. He said he took only 1 sec. DVB/h. He also said – as did all other students with glasses or contacts - that he didn't have UV. However, when I asked for his prescription, he said he had +1D in one eye and -2D in the other - and that his prescription hadn't changed for 3 years. However, as shown in the graph above, a difference in spherical power of 3 Diopters is strongly associated with a loss of stereo vision.[62]

The graph – Fig 4 in the original - shows this is particularly true for distance vision: 92.5% of those with a 3 Diopter difference in their eyes, completely lack stereo and 5% more have poor stereo. It's reasonable to assume [95% probability] that this student had no significant stereo vision. It also appears from the fact that all those with UV in this study had no worsening of myopia – 5 of 6 had no myopia at all—that some of those with little or no DVB in the no glasses group may actually have UV in the form of no stereo vision and not be aware of it.

It also suggests stereo vision provides a strong cue for the real distance the eyes are focusing at and is part of the system that controls eye growth. A substantial fraction of the general population has relatively poor stereo vision[63,84] a factor that may protect them in some degree from myopia.

10-30 The most noteworthy response in this group was B-22 who said he takes breaks every 5 minutes for "3-30 seconds" & "looks around" – but he said this is mostly to think about what he has just read, not to look at and focus on anything. He felt that only about 5-10% of this time is actually DV with focus –on clock, students, etc. It's important to emphasize here that merely lifting one's eyes from the page doesn't constitute DVB and doesn't necessarily involve any focus at a distance – or any focus at all.

It's also important to show that the numbers on the graphs [on p. 36] and in the analysis, are the averages of ranges the students gave. Twelve episodes of 3 second breaks of which only 5% is DVB yields 1.8sec/h; 12 episodes of 30 second breaks of which 10% is DVB, yields 36 sec./h. In this case, the average of 3 and 30 sec/break [16.5 sec.] was multiplied by the average of 5 and 10% [7.5%]=1.24sec/break. With 12 breaks per hour, this comes to 15 sec./h. A better analysis and graphic display should take into account such ranges – and/or the students should be interviewed more carefully to narrow the range or find what they think is the most representative value.

The values used for students B-7,10,12 & 17 involved some additional estimation – as shown by a red E next to their DVB data in Table B. Students B-7&17 both said they "sometimes walk around" the Bes Midrash. Walking around is more for physical exercise than for eye exercise: we can walk around without looking at anything at a distance. B-17 said "sometimes" and "40 to 60 seconds per hour walking around". From this I estimated 20sec/h DVB and applied it also to B-7 – who didn't give a specific amount of time. B-10 said every hour he takes a break of 2-3 min. to get a glass of water & that he 'looks around a little'. Getting a glass of water may involve no DVB. It isn't clear from the record of the interview how much of the 'looking around' was while on the water break and how much aside from that. Since the expression *'looks around* a little" is similar to what B-12 said: 'maybe 10 sec. breaks to *look around*", I've given both 10sec/h for DVB– because of "maybe"—of B-12 and "little"–of B-10 [emph. added] but the language could mean 2-3× that for both: 3× values are used in a supplementary analysis. See § 6.2.iii.

Here, we'll use an intuitive weighted avg. of the range of possibilities for B-17[64]: This is ~1.5× original estimate of 20sec/h for the best single value. The same factor of 1.5 is applied to all four of the original single value best estimates, yielding 30sec/h for B-17&7

less incentive to look at distant things as the distant things – including the clock, etc. -- would not be clear.]

[62] Maciej Gawecki, 2019.

[63] R.F.Hess, 2015 robert.hess@mcgill.ca

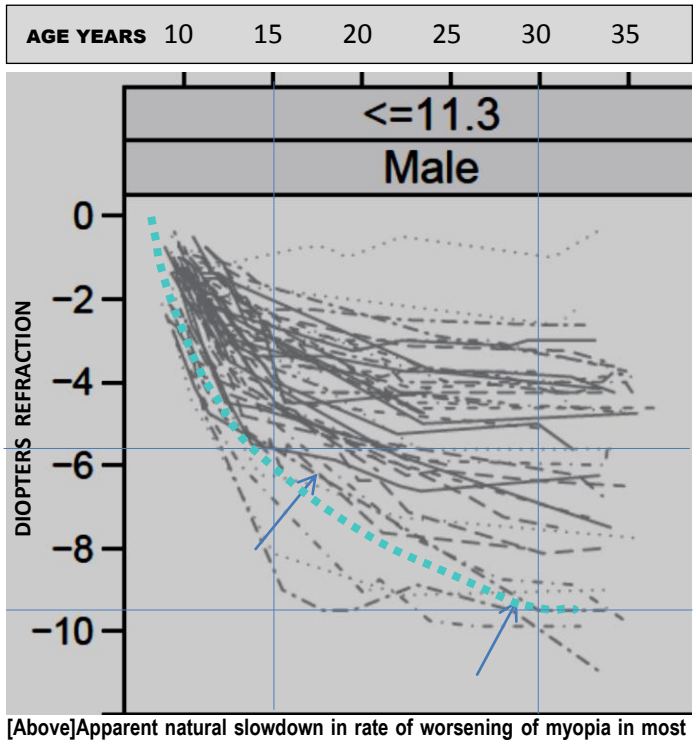
[64] (1×16)+(2×17)+(6×20)+(5×30)+(3×40)+(2×50)+(1×60)=600; ∑ of weights =20; 600/20=30;=1.5×single best guess. Weights are for probability weighted calculations at §6.2.i and Monte Carlo simulation.

and 15sec/h for B-12&10. For the unlikely – but still plausible- case, use 2x this weighted value=60 for B-17&7 & 30 for B-12&10. There is a ([3+2+1]×5%)= 30% chance here for B-17&7, that each will be >30 and a (1×5%)≈5% chance that each will be ≥60.

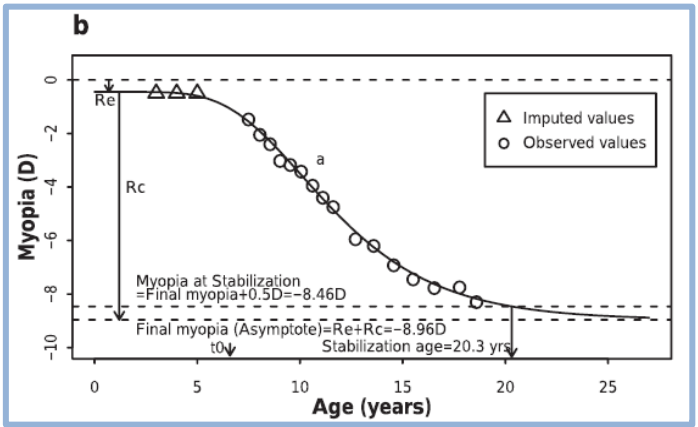
B-21. combined the highest myopia found among the students: -9.0 and -9.5, with zero change in his prescription in the past year. [This could be because the doctor wanted to try under correction—re-interview, but may-be he wouldn't know!] He said that every 3-5 minutes he took breaks of 1.5-2 seconds each[65] to look at a clock ~10 ft. away. The difference between his 10 foot distance and the usual standard of 20 feet comes to about 1/6th of a diopter which is not significant in this context. His break data gives a range of 18 to 40 sec/h[66]. Taking the average of these yields about 29 sec/hour.[67] This is just over the 25sec/h I used as a preliminary boundary for apparently effective hourly DVB time.

I set the initial boundary at 25sec/h to include this student on the side of DVB apparently stopping the worsening of myopia. This was based on the idea that very high myopia may tend to slow down by itself -- as suggested by the 2 figures, at right.[70] [68] This led me to think that a much lower dose of DVB may be effective in stopping its worsening in such cases. However, the rate decline in these figures may result from reduction in the kind of stresses that come from studying – as young men leave college –not a spontaneous, age related decline.

It's been shown with microscopists, that substantial increases in myopia can occur even in one's thirties – if the eyes are exposed to a strong stimulus in this direction[69]. As shown graphically by Saunders, [p.18][98],



[Above]Apparent natural slowdown in rate of worsening of myopia in most men with High Myopia between age 20 & 25. Exception [marked by ASA with arrows & grid lines] whose myopia appears to increase steadily at 0.26D/y from age 15 to 30- is an artifact of 2 widely spaced measures: -4.9D at 12.37y & -9.5D at 29.66y. Heavy dotted line based on O.P.'s hand drawn curve [Pers. comm. from O. Parssinen. 5/29-31/'20, case # 98] Partial image of Fig 1,[70]



MYOPIA STABILIZATION AT 20.3 YEARS FOR -8.96 MYOPIA[68]

myopia may increase steadily through adulthood to very high levels. There are 2 other students in this pilot study with very high myopia:

A. Student B-11 has -8.5D, very low DVB time of about 2 sec/h and an average rate of worsening for the group: 0.5D/y. Presumably he is studying about as intensively as the other students and as he himself had studied in previous years.

B. B-20 also has -8.5D, but an ambiguous worsening rate: 0.25 or 0.00 D/y. He's not in the main analysis because of this ambiguity, is self-selected & at 26 –more than the early 20's range of the other students. His DVB is 3sec/h. See supplementary analysis at §6.2.ii.

[65] This is very similar to the pattern of students A2 & A5.

[66] If we assume total DVB time/h is to accomplish something, it may be that shorter breaks combine with greater frequency & vice versa. So there will be 2sec, 12×/h = 24 sec/h and 1.5 sec, 20×/h= 30sec/h, avg.= 27 sec/h.

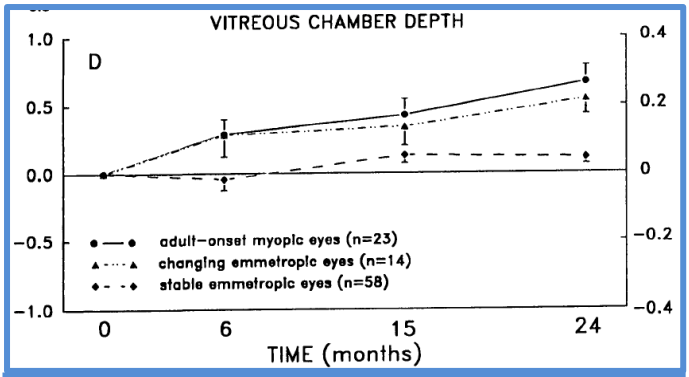
[67] I didn't ask him if he engaged in similar behavior in prior years. I know his first name & where he was living at the time I interviewed him –so I may be able to obtain more of history – to better understand how his myopia got so high. It could be that when his myopia was lower, -2 to -4 D, he could read without glasses but could not see clearly at a distance. The result is that he did not try to look at anything in the distance did not have the DVB that could have prevented his eyes from getting worse

[68] Fig.1. b : Leslie Hyman, COMET Group, 2013

[69] A. see Fig 1-A, next page, [Shows adult onset & incr. of myopia after age 26 in a study of UK clinical microscopists] N. McBrien & D. Adams, 1997,

B. Bjarn Simensen & Lars Ola Thorud, '94, 469-71, Quality control adult textile workers, 30cm viewing distance, showed incr. myopia -2.56D: +1.19D & axial length 24.36:22.70mm with decades of work compared with matched case controls.

[70] Fig. 2, above [& Table 1, not copied here], O. Parssinen, et al, 2014:



CHANGE IN VITREOUS DEPTH, RIGHT SCALE, MM & MYOPIA, LEFT SCALE, DIOPTERS, AMONG ADULT MICROSCOPISTS FOLLOWED FOR 2 YEARS. NOTE: 58 OF 95 EYES HAD NO CHANGE & AVG. TOTAL CHANGE OF THOSE 23 WHO BECAME DEFINITIONALLY MYOPIC WAS ONLY ABOUT 0.75D IN 2 YEARS. "THE AVERAGE (MEDIAN) AGE OF ONSET OF MYOPIA IN THE EMMETROPES IN WHOM ADULT ONSET MYOPIA DEVELOPED WAS 26.3 YEARS WITH A RANGE OF 22 TO 44 YEARS" FROM P 327-8, MCBRIEN ET AL, SEE FOOTNOTE 69

Below are all students in this study in their early 20's that have relatively high myopia & both rate of change & DVB data, in order of decreasing myopia:

B21	9.25D[71]	0.00D/y worsening	&	29[66] DVBsec/h
B11	8.5	0.5		2
B2	5.5	0.27e		0
B22	5.5	0.56 [72]		15
B15	5.0	0.4e		0e
B23	4.75	0.0		300
B10	4.5	0.33		10e
B5	4.0	0.5		0

The rate of change of those with low DVB is about the same as the median and mode of those in the whole "eyeglasses" group who had a non-zero rate of change and there doesn't appear to be any slowdown in rate at higher levels of myopia. [TRY TO RE-INTERVIEW B-21]

>30 <60 There are no students in this range- suggesting a good place to put a dividing line for effective DVB. I put it at 45sec/h. But see §7.4.E.

60-360 There are two students in this range, both remarkable in their own way. B-23 with 300 sec/h of DVB had zero change in his -4.75 prescription. He said that his prescription had been the same the past for three years. He did not have any qualms about reporting his one minute breaks five times an hour and gave details about the need for glasses by parents and siblings. I did not think to ask him what he may have been doing differently in prior years – before his prescription stopped changing.

Based on these results so far-- and the work of Winewar & Wallman[8] -- it's likely that only a fraction of this 300 sec/h should stop the worsening of myopia – probably only about 1 minute/h. [It may be possible to re-interview him – though I didn't ask even his first name.]

However, student B-24 – the last interviewed for this study -- has 360 sec/h DVB and his myopia is increasing– by about .25D in the last 1.5 years: from -3.5D to -3.75. This appears to defy the rule that seemed so well confirmed by the previous data[73]. However, his father has -11D & -12D myopia and his mother has no myopia.

He may be a case where the genetic and environmental pressure toward very high myopia is partly offset by an extra high dose of DVB. He said he's one of 12 children – with several younger brothers and older sisters. The sisters have a different – much less myopogenic – educational program[74] and the brothers are mostly too young to see how their vision is developing. There is some reason to believe that high myopia or very high myopia have a distinct and sometimes dominant genetic component[75].

5.1.c Length of Each Break.

The previous two subsections dealt with the total amount of DVB time per hour. This part covers the length of each individual break.

Eleven students in the No Myopia Group reported non-zero total DVB/h. Nine of these provided data on the typical length of each DVB break. Two more gave total DVB/h but did not give individual break length or this break length data was ambiguous. All 9 of those with individual break length data had over 45 sec DVB per hour.

Thirteen students in the Myopia Group reported nonzero DVB/h. Only 5 of these 13 gave information on individual break lengths. Of these, just 2 had total DVB/h over 45 seconds and only one of these had zero Worsening of Myopia [WM] in the past year. The other, B-24, had very high DVB/h and very low worsening. One more, B-21, with less than 45 sec/h DVB, very high myopia and 0 WM in the past year, also provided data on break lengths.

[71] Myopia shown is avg. of 2 eyes. For individual eye data see footnote 103d.

[72] This is the 2-eye avg. For eye with higher rate of worsening it's 0.667D/y; range for this eye is -0.593-0.771D/y. For details, see footnote103d.

[73] He was self-selected after I had collected what I thought was all the data I needed and run preliminary statistical analysis. I mentioned to him- in the course of discussion related to this project- that I'd found DVB to be helpful in preventing or stopping the advance of myopia. He said his own situation contradicts these findings – so I interviewed him- and re-did the analysis. In retrospect, it is not clear if his DVB was planned or spontaneous. If planned, he would be the only one whose DVB wasn't spontaneous.

[74] Young women from the same families as the Yeshiva students have <1/2 as many with myopia & ~1/5th as many with high myopia compared with their brothers. See footnote 17-B: Zylbermann et al, table 2.

[75] A. Jeremy A Guggenheim, 2000; B. Terri L. Young, et al, 1998a; C. Terri L. Young, et al, 1998b D. Erik Skeller, 1954, Thesis. Copenhagen. E. Ernst Goldschmidt, 2003.

There were a total of 10 with ≥45sec/h DVB, zero WM/y[76], and specific break length information. The table below shows the break length data for these ten in order of the interviews, The data, as provided by the students, is usually given as a range of seconds per break. The first number in brackets is the value actually used in calculating DVB/h –based on a simple average of the range, except where noted. The 2nd number in the brackets, in *italics*, is the log value of the first.

A-1:	20-30,	[25, *1.40*]	A-2:	2-3,	[2.5, *0.40*]
A-5:	2-3,	[2.5, *0.40*]	A-12:	24-120	[60, *1.78*][212]
A-16:	60-120,	[90, *1.95*]	A-20:	60,	[60,*1.78*]
A-23:	120,	[120, *2.08*]	A-24:	15,	[15, *1.18*]
A-26:	15-50	[32.5,*1.51*]	B-23:	60,	[60,*1.78*]

Mean 46.75±38.53[77] [The standard deviation is close to the value of the mean, which would result in a substantial fraction with negative values.]

Mean log 1.39±0.606[78] , antilog = 24.54 sec. N=10
Medians: 25, 60
Mode, 60 sec

Half of these values are between 2.5 and 32.5 seconds each – which according to the studies with hatchling chicks, should have little or no effect on myopia curtailment, [8, 12.G] [& Table, p 34].

Excluding the 1.5-2 [1.75, *0.243*] sec. breaks of B-21, which may've been effective in stopping the increase in myopia though totaling only ~half a minute/hour, we have a "short breaks group" of 5.

Log mean =0.978± 0.541[79], antilog = 9.51sec/break
Median:15; mode 2.5; range 1.75-32.5 sec/break

Excluding B24 [90, *1.95*] who had WM[80] we have an effective Long Breaks Group of 5:

Log mean = 1.874±0.137[81], antilog =74.8sec/break
Medians: 60; mode 60, range 60-120 sec/break

The break length figure of A-19 – given as 2 minutes every 2 hours gives an average of 60 sec/h total DVB. However, the length of each break is ambiguous: It could be a single 2-minute break every two hours or 2 one-minute breaks or a total of 2 minutes in 2 hours divided up in various ways.

[76] As noted previously, zero WM includes both those with no myopia at all & those whose prescriptions didn't change in the past yr.
[77] https://www.calculator.net/standard-deviation-calculator.html?numberinputs=25%2C2.5%2C2.5%2C60%2C90%2C60%2C120%2C15%2C32.5%2C60&ctype=s&x=55&y=16
[78] https://www.calculator.net/standard-deviation-calculator.html?numberinputs=1.40%2C0.40%2C0.40%2C1.78%2C1.95%2C1.78%2C2.08%2C1.18%2C1.15%2C1.78&ctype=s&x=68&y=18
[79] https://www.calculator.net/standard-deviation-calculator.html?numberinputs=1.40%2C0.40%2C0.40%2C1.18%2C1.51&ctype=s&x=49&y=15
[80] As noted above, B-24 may be a case where genetic & environmental pressure toward very high myopia is partly offset by an extra high dose of DVB.
[81] https://www.calculator.net/standard-deviation-calculator.html?numberinputs=1.78%2C1.95%2C1.78%2C2.08%2C1.78&ctype=s&x=48&y=18

5.2 Unbalanced Vision: [UV]

None of the students who reported UV had any obvious strabismus or anything else notably different about the appearance of their eyes. Students A-1 and A-2 were not asked about UV and, as we'll see, very likely didn't have it.

Students A-6, A-8 and A-9 were seen not wearing glasses – and the latter two didn't need them. However, my standard introductory remark: ~"I notice you're not wearing glasses." -- led these three to respond that they had various forms of UV, and I didn't interview them further. These reports of UV – before I was even aware of the question – may be because they had the usual childhood experience of trying to treat their UV with glasses. It suggests it's even more likely A-1 and A-2 didn't have UV – beyond the probabilities associated with those who were explicitly asked about it.

With at least 5[82] having definite UV out of a total of 15 not wearing -and apparently not needing- glasses or contacts at the time of interview, compared with only 1 with apparent UV out of a total of 20 wearing glasses for myopia, it looks like UV could be a significant factor in preventing myopia: 5/15:1/20, P= 0.0301[83]. The following provides data on each of these 6. As noted above, A-6,8,9 weren't asked about and didn't volunteer info on DVB. Additional data is in Tables A & B.

A-8	not myopic; 1 eye for distance, 1 for near; switches automatically between eyes; no headaches.
A-9	not myopic; one eye good for both near & far; same thing for most immediate family—but cousins have significant myopia.
A-12	1 eye good for near & far; 1 eye -4D; no glasses.
A-14	1 eye good for near , 1 for driving; ≥3 brothers , 11, 14,19, no glasses
A-16	1 eye good near & far, 1 good only near; father & 1 brother: no glasses, 6 brothers do have glasses.
B-14	Prescription +1D, -2D: =Δ 3D, strongly associated with no stereopsis; 0D/y change; see footnote 62.

Students A-5, A-13, A-18, A-20, A-22, A-23, A-24, A-25 and A-26 were asked about UV and said that they did not have it. One of these students, A-25, answered my question on UV but refused to answer the following question about DVB. He did give his first name and the city he's from – so it may be possible to re-interview him.

As already noted in the DVB section, §5.1.a-60, student A-19 was interviewed among a group of eyeglass wearers who were, when interviewed, all asked about UV. My written record of this student's interview does not show an answer to this question – as is true with several of those who were interviewed in the "wears glasses group."

[82] A-6 excluded as he is presently wearing glasses. See footnote 226
[83] https://www.medcalc.org/calc/comparison_of_proportions.php; However , Fisher exact test shows only 0.06396474 https://www.medcalc.net/statisticaltests/fisher.php

The interview sheet for this student just says "No" [see image of page, at p.11],which probably means "No" to all the questions he could have answered "Yes" to – almost certainly including the meaning: No UV. Intuitive likelihood of "No" on UV: ≥95%.

As noted above [§5.1.b.ii-0-<10sec/h], 1 student with glasses very likely had UV: B-14. He almost certainly had no stereo vision but was apparently not aware of it. Maybe others did not have stereo vision without having other types of UV and - like B-14- were unaware of it. ~7% of adults under 60 are stereo-blind.[84,62,63] This is consistent with the 1/20 rate of Group B: P=0.73. However, the 5/15 rate of UV – probably all of them stereo blind – of Group A is 4.76× higher: P=0.0001.[85]

5.3 Genetic Factors and Myopia

Several students appear to have been protected from myopia by strong genetic factors.

A-9 Already noted under UV: no myopia; 1 eye good for both near & far; same thing for most immediate family—but cousins have significant myopia. The character of the other eye & DVB were not noted.

A-13 Already noted under 0 DVB; extremely reading intensive program with no myopia, no known UV and both parents and all siblings myopia free. It may be possible to find him & test for e.g. no stereopsis[86] -- & re-interview about siblings & grandparents.

A-18 Genetic & noted under 0 DVB[§5.1.a.ii-0]. It may be possible to re-interview him. His father was sent a draft of this report betw. 1/19/'00 and 1/28/'00 by an intermediary Y.H. Y.H was also sent four of my sforim.

A-24 has a lot of DVB time – but the tendency to look around a lot may be familial as neither of his parents and none of his 11 siblings have or need glasses and his "whole family" has the tendency "to look around."

B-24 Tied for highest DVB with 2 in "no myopia group": 360sec/h. This may be a case of a strong genetic tendency to very high myopia partly offset by very high DVB. Of 6 with worsening myopia who don't have estimated data, he has lowest rate: 0.17/y.[87]

A genetic tendency to a specific pattern of DVB is supported by the extreme similarity of DVB and appearance of Students A-2 and A-5. Further information on this should be possible when re-interviewing Student A5. Re: brothers' DVB?]

Only Student A-13 is included in the category MF for Myopia Free Family in the main analysis. A-9 and A-18 have immediate family who are myopic or have vision substantially different from the student interviewed in apparently relevant ways. A-24 is clearly genetic – but the genetic factor is influencing the DVB pattern—and it's that pattern that is apparently protecting the student and his family from Myopia. There is some likelihood A-22, with 20sec/h DVB and no UV, has genetic protection – but there was no time to ask about his family.

Very High Myopia:[≤-10D, either eye[88]] was found in fathers of 2: A-18 [-13D] and B-24 [-12D] though students were rarely asked for their parents' prescription. These 2 students had 0 and -3.75D respectively. This suggests that a substantial fraction of these students have a combination of genes and environment that leads to very high myopia by middle age.

An earlier version of this report was submitted to medRxiv Mar.10/'21 [A.S. Adler, 3/10/21] & rejected, *inter alia*, because of "causal language" throughout the report including the "title and abstract". "The medRxiv team" suggested using "such language as: 'is associated with'".

In a retrospective study like this, it's easy to confuse correlation with cause. One could say, hypothetically: High correlations found here between DVB & curtailment of myopia aren't the result of DVB, but of some other, unstudied factor whose presence is indicated by DVB. For example, there could be a genetic factor which is responsible for curtailing myopia & the presence of this factor is indicated by DVB. So, in this hypothetical case, DVB alone has no significant effect on myopia curtailment. This could be a reasonable guess if we didn't already have results of interventional, prospective studies with apes **[F. Young,'61]**, birds [**J. Winawer and J. Wallman, '02]** and other species **[J. Wallman and J. Winawer, '04]** that showed imposed behaviors strongly influence development of myopia. The original title was and remains reasonable – but has been altered – together with the language of the report – to facilitate more rapid dissemination of these results.

"The medRxiv team" also required that I "remove all information that would allow the patient or their family, friends or neighbors to identify them (e.g., age, precise location, date of hospital admission, family relationships, past medical history, etc)." These interviews weren't conducted in a medical setting but in public or semi-public places & the information gathered involved use of glasses-- usually worn on the face for all to see. The behavior surveyed - Distance Viewing Breaks during study periods- was also easily visible to both teachers & fellow students.

"The medRxiv team" also required that there be "less than three indirect identifiers [such as]- Age range*- Ethnicity*- Religion*- Details about family and family history- Potentially identifying medical conditions- Occupation*- Professional affiliations- Geographical area*." Since nearly all students interviewed had ≥5 such "indirect identifiers" [* in the list] and there are thousands of others in the same geographic area that have the 4 other, non-geographic, identifiers in common, such information can't be used to identify students in this study. As this relative homogeneity was a key element of the study design, these indirect identifiers have not been removed -- but other identifiers have been deleted wherever possible.

The actual level of myopia may appear to be an obvious direct identifier – particularly when combined with rate of change. However, for each of the 21 students interviewed in the "wears glasses" group, there are 100+ spectacled students in the same area with the other 4 indirect identifiers in common. This doesn't include many thousands of additional students who may've been in the area when I conducted interviews or >2× these numbers who don't speak English but who I may've interviewed in Yiddish or Hebrew. With several hundred students for each interviewee, it's very unlikely any could be identified – particularly considering that the rate of change data was calculated by the author and not elicited directly.

"The medRxiv team" response was received 3/25/'21
MS ID#: MEDRXIV/2021/253272
The report was finally rejected on a claim it wasn't OK'd by a Medical Ethics Committee!!
See footnote 47, p 8-9

5.4 Level of Myopia

Each student with glasses or contacts was asked for their current prescription. If their eyes were different, data for both eyes were recorded. Only B-19,

[84] A.Chopin, D.Bavelier, D.Levi. 2019.

[85] A. Incidence of amblyopia [also called lazy eye] & strabismus [cross-eyed or wall-eyed] is relatively low in Israel population:0.8% among military pre-enlistees in '12, age 17.4±0.6y; [This tends to exclude the Chareidi community –& all who come from America to study in Yeshiva in Israel.] Yinon Shapira, et al, '18. B. In a national represent. survey of non-institutionalized, civilians in S. Korea, 1.1% of males 19-29 had strabismus, 75.3% of m+f had myopia. 'Myopia' was worse than -0.75D. Kyung-Chul Yoon, et al, 2011

[86] However, as he seemed to be very aware of the special character of his family, it's likely he'd know of lack of stereopsis & say so when asked about eyes working together. There's a relatively rare condition "congenital alternating squint" where a person has "two healthy eyes, and the ability to switch (by choice) between seeing with either eye. However, stereoscopic and three-dimensional vision can never be achieved in this condition".

[87] This is based on his estimate that his eyes have gotten just a little worse in the past 1.5 years – he estimated this little bit as being .25D in 1.5 years. Before that the rate was .5D/y for 1.5 years.

[88] A. 0.5% of refraction clinic popul. had worse than -10D E.Matamoros,et al, '15. The % with Very HM is ~1/5-1/20th of % with HM. B. Min Chen, et al, '18

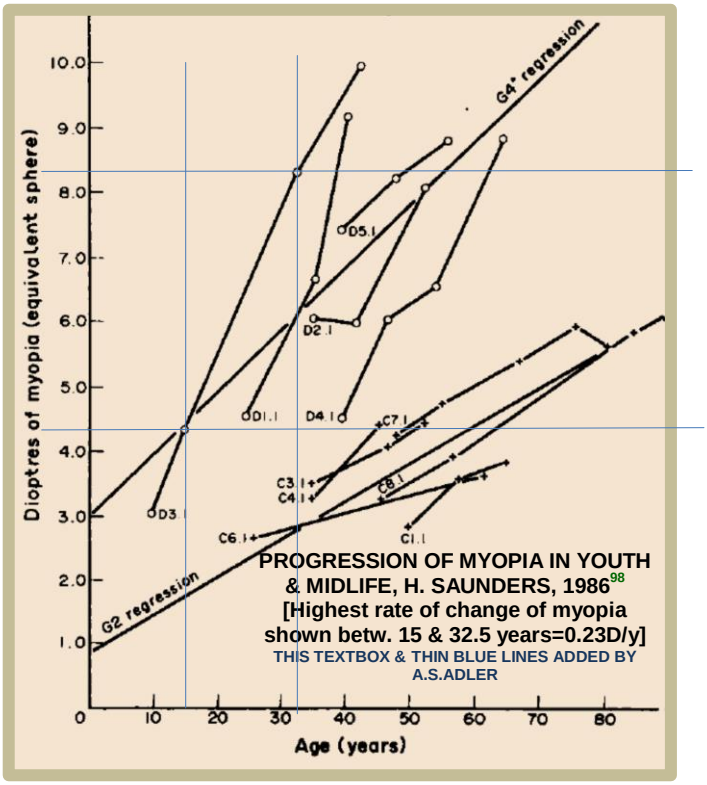
didn't give a specific number – saying that it was "low" – i.e. not strong – and I could see this through his lenses. I estimated -0.7, the only estimate for current prescriptions. Students were not asked about astigmatism or if they were wearing bifocals or Progressive Addition Lenses [PAL's].

Including the one estimated value, data were obtained from 20 of the 24 students approached for an interview in the "wearing glasses or contacts" group. Of the 4 others, one, B-20, with -8.5D, was, at 26, too old for the group[89] and also had ambiguous rate of change data. B-4 belonged in the "no myopia group" and was transferred to that group – as already noted. Two refused to answer any questions. The mean for the 20 was -4.00±2.26D[90,91]; the median was -3.75D; the range:-0.7D to -9.25D. Excluding those three with zero rate of change- B-14, B-21 and B-23 - the mean for the 17 was -3.85±1.87D[92]. The median was -3.75, and the range was -0.7 to -8.5D.

5.5 High Myopia

High myopia is usually defined as spherical equivalent of -6.0D or worse in the worse eye[93]. Spherical equivalent includes both basic lens strength plus effects of astigmatism. As no data on astigmatism was collected from the students interviewed, there's a chance in marginal cases the astigmatism will push the prescription either into the High Myopia zone or out of it. There were two students with unquestionable High Myopia, and two just at the definitional boundary: From the highest to the lowest level of myopia, they were:

	-DIOPTERS-		
STUDENT #	WORSE EYE	BETTER EYE	AVERAGE
B-21	-9.50	-9.00	-9.25
B-11	-8.75	-8.25	-8.50
B-3	-6.00[94]	-6.00	-6.00
B-22	-6.00	-5.00	-5.50
AVG. of 4	-7.56±1.83		
4 of 20=20.0%			
B-2	-6.00[95]	-5.00	-5.50
AVG of 5	-7.25±1.73		
5 of 20=25.0%			



These numbers are consistent with the two available[96] reports that give data on High Myopia among Yeshiva Students in Israel: I. 20.4% of 193 myopic 14-18 year old students in '93, Zylbermann, et al[17-B]; and, II. 33.6% of 1,871 myopic 17-18 year old students in 2013, Bez et al[17-A]. Both percentages would be higher if the groups were in their early 20's like the students in this Pilot Study.

Because of the study's small sample size, differences between the 33.6% of Bez, et al, and either 20.0% or 25.0%, calculated above, aren't statistically significant – with P=0.20 & 0.42, respectively.[97] This indicates that this convenience sample, pilot study is relatively representative as far as High Myopia is concerned – and numerically conservative – on the low side of the underlying reality.

5.6 Rate of Change of Myopia[98]

After obtaining the current prescription, each student was asked for their previous prescription and how long it was before the current prescription. Eight students were able to give complete data including 3 that had zero change in their prescription in the past year. One student, B10, reported his 2 most recent prescriptions and "how long ago" the earlier one was – but not the time since the most recent. The underscored figure assumes the most reasonable value for "how long ago" his latest prescription was, based on 6 students who supplied such data.[99]

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[89] Too old: from possible combination of "growing out of it" effect & a very different study program & level of study intensity.

[90] https://www.calculator.net/standard-deviation-calculator.html?numberinputs=2.5%2C5.5%2C6.0%2C4.0%2C2.25%2C3.5%2C3.75%2C4.5%2C8.5%2C2.0%2C2.25%2C0.5%2C5.0%2C2.5%2C3.25%2C0.7%2C9.25%2C5.5%2C4.75%2C3.75&ctype=s&x=55&y=14

[91] This is 2 eye avg. & compares with -4.26±0.37D [n=42] for 18y old young men in Jerusalem Orthodox Schools in '93. Zylbermann, et al '93

[92] https://www.calculator.net/standard-deviation-calculator.html?numberinputs=2.5%2C5.5%2C6.0%2C4.0%2C2.25%2C3.5%2C3.75%2C4.5%2C8.5%2C2.0%2C2.25%2C5.0%2C2.5%2C3.25%2C0.7%2C5.5%2C3.75&ctype=s&x=49&y=11

[93] Definition used in most recent study involving High Myopia among young men in Israel. See page E2 , col 2 of Dana Bez, et al, 2019

[94] Only avg. of 6.0 was recorded; 6.0 for both eyes is pro-forma.

[95] Data were recorded as -5 or -6 instead of -5 & -6. Either student wasn't sure of current prescription or there was some other communication error.

[96] Older '83 Hebrew rept, not immediately available – try to get it. See also: Girgis, A.M. 1948;."Girgis found 12.5% of all myopias among secondary school children in Egypt to have a refractive error of -12D" from A. Av-Shalom, et al, 1967

[97] Calculated at https://www.medcalc.org/calc/comparison_of_proportions.php

[98] Harold Saunders, 1986, p 84, Fig. 5,

[99] Data removed pursuant to request of "the medRxiv team". See text box, p.17.

B5 -0.60D/y	B10 -0.45D/ye	B11 -0.50D/y
B14 0.00D/y	B17 -0.25D/y	B21 0.00D/y
B22 -0.67D/y[100]	B23 0.00D/y	B24 0.17D/y

Excluding those 3 with no change, the mean rate of change of myopia for these 6 is -0.44±0.20 D/y.[101] 3/6 of those in this group with non-zero rate data, had a rate of worsening of myopia of ≥0.5D/y. This is about double the highest rates for the early 20's in the charts of Saunders[98], above, and Parssinen[70]. However, it's reasonable that those who remember their prescriptions most accurately are those with the highest recent rates of change.

Five additional students reported the most recent change in their prescription and how long ago the change took place, but not the time between pre-scriptions[102]. One more, B-6, reported his two most recent prescriptions but not the time between them or when either of them took place. For these 6, this isn't enough to compute a yearly rate of change with-out knowing how frequently the students changed prescriptions. Current annual rates were estimated for these 6 by combining information on time be-tween prescriptions and time since the last change for those who gave such data[99], with insights on frequency of change from other Brisk students who were subsequently interviewed to learn more about this specific factor.[103] Where two comparable[104] me- thods of estimation were available,[105] the average was used. For these 6 alone, [blue in the list] the mean rate of change of the more rapidly worsening eye was 0.40±0.25 D/y.[106] Combining these 6 with the first 6 that had more complete data and non-zero changes, mean rate of change= -0.421±0.217D/y.[107]

Three more students [purple in list] gave only their current prescription and when they first started wearing glasses[108]. Rates of change were computed assuming their initial prescription was -1.40D [109] and the current rate of change was 1/3 less than the average for all the intervening years[110]. These 3 were worsening at -0.209D/y. This relatively low rate could be because those with rapidly worsening myopia would more likely remember the most recent changes and less inclined to rely on when they began wearing glasses. Adding these 3 to the 12 with non-zero values, the mean rate of change in myopia for all 15, is -0.38±0.22 D/y.[111] Including the 3 with no change, the rate for all 18 myopic students was -0.32±0.25D/y. [112,113,114,115]

This means ~13% of myopic Yeshiva students in their early 20's have myopia worsening at ≥0.6D/ y

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[100] Data removed pursuant to request of "the medRxiv team ". See text box, p.17.

[101] https://www.calculator.net/standard-deviation-calculator.html?numberinputs=0.60%2C+.45%2C.5%2C.25%2C.67%2C.17&ctype=s&x=40&y=14 If 'how long ago' last prescr. was =0y: B10=0.33D/y; mean =0.42±.20D/y. https://www.calculator.net/standard-deviation-calculator.html?numberinputs=0.6%2C+.33%2C.5%2C.25%2C.67%2C.17&ctype=s&x=58&y=18

[102] These are the first 5 shown in footnote 99.

[103] a. Prelim. interviews with 5 Brisk students with glasses for myopia [11/21-22'19] suggest usual rate of change of prescript. is ~1 per 1-3ys. One of these 5 noted he'd changed his prescr. every y for several ys – as his prescr. was getting significantly stronger each y. His last prescr. was only slightly worse than previous & time between this & the one before it was 1.5ys. This suggests freq. of change depends partly on rate of change.

Data removed pursuant to request of "the medRxiv team". See text box, p.17.

[104] Comparable isn't the same as equal. More precise methods should be used where time & resources permit.

[105] The 2 methods were matching with another student who had the same amount of change between prescriptions or using an avg. of a group.

Data removed pursuant to request of "the medRxiv team". See text box, p.17.

[106] https://www.calculator.net/standard-deviation-calculator.html?numberinputs=.312%2C+.625%2C+.625%2C+.114%2C+.114%2C+.625&ctype=s&x=62&y=14

[107] https://www.calculator.net/standard-deviation-calculator.html?numberinputs=0.6%2C+.33%2C.5%2C.25%2C.67%2C.17&ctype=s&x=58&y=18

[108] These are B1, B13 & B15.

[109] Received data for boys >11.3y at 1st prescription from Prof. O. Parssinen, 5/29/20: [see footnote 70] 42 boys ≥11.51y; 0 >12.65y at 1st prscr.; avg. age: 11.87y; avg. 1st prscr.:-1.40D±0.54; no correl. with age, P=0.925. All cases were from Finland in 1971-'73, comp. to 2010+ & mostly USA, here. The present report formerly used -.75D from visual inspection of chart, p14, top. Boys in early '70's Finland may've seen glasses as a stigma & delayed use. Yeshiva students expect to have glasses in this age range & it may be a sign of maturity. Of boys, age 14, in Jerusalem, 35/43 [81.4%] of those in Yeshiva & 15/56 [26.8%] in secular schools, were myopic. Avg. level of myopia in the 2 groups of myopes was -2.83D & -1.67D, resp. [Zybermann, et al,'93]; In Finland, 23% of 15 yr. olds [M&F] were myopic. [M. Mäntyjärvi,'83]; In the USA,['71-'72] 22.9% of boys [27.9%M&F]12-17, wore glasses, of which 22.4% [M&F] for myopia. [J. Roberts, '78, Table 5&37]. Thus, the new data are used for rate of change but not in regression functions [See p 38 & see footnote189-B] https://www.calculator.net/standard-deviation-calculator.html?numberinputs=-1.63%0D%0A-2.13%0D%0A-1.5%0D%0A-2.88%0D%0A-1.25%0D%0A-0.5%0D%0A-1.25%0D%0A-1.13%0D%0A-0.38%0D%0A-1.0%0D%0A-1.25%0D%0A-1.5%0D%0A-2.38%0D%0A-1.25%0D%0A-1.0%0D%0A-1.5%0D%0A-1.5%0D%0A-1.0%0D%0A-0.63%0D%0A-1.5%0D%0A-0.75%0D%0A-1.25%0D%0A-1.0%0D%0A-2.13%0D%0A-1.25%0D%0A-1.75%0D%0A-1.5%0D%0A-0.8%0D%0A-2.13%0D%0A-1.5%0D%0A-1.25%0D%0A-1.63%0D%0A-1.5%0D%0A-1.63%0D%0A-1.75%0D%0A-2.63%0D%0A-2.0%0D%0A-1.0%0D%0A-1.25%0D%0A-1.0%0D%0A-0.75%0D%0A-1.13%0D%0A&ctype=s&x=60&y=19

[110] 2/3 of avg. rate may be too low: some students have an increasing rate of myopia or get myopic for 1st time when in college.

[111] https://www.calculator.net/standard-deviation-calculator.html?numberinputs=0.60%2C+.45%2C.5%2C.25%2C.667%2C.17%2C.3125%2C+.625%2C+.625%2C+.114%2C+.114%2C+.625%2C.137%2C.096+%2C.393&ctype=s&x=60&y=17

[112] https://www.calculator.net/standard-deviation-calculator.html?numberinputs=0.60%2C+.45%2C.5%2C.25%2C.667%2C.17%2C.3125%2C+.625%2C+.625%2C+.114%2C+.114%2C+.625%2C.137%2C.096+%2C.393%2C0%2C0%2C0&ctype=s&x=59&y=21

[113] Highest rate I've found so far of increase of myopia of college-age men in a prestigious college was of Amherst College, Mass, USA, 140y ago, by Hasket Derby In ~3.8y from avg. age 19 to avg age 23, 254 students [of starting group of 351, 97 left schl early] were followed through all 4yrs. 29 students entering emetropic left with avg -0.982D, myopia. 58 entering myopic, increased myopia an avg. of -0.884D. For these 87, avg. change =0.917D = .24D/y. 32 others entering my-opic had no change. 90 entering myopic had avg. on entrance -1.786D & left with an avg -2.436D; avg -0.178D/y. Avg. for 39 who entered with hyperm. was +0.7D; same after ~3.8y. Highest Δ of 58 who started with myopia & increased: =-2.5D from start-1.0D= -0.66D/y. 2 others had Δ 2.25D=.59D/y. The "First scholar in his class"[starting at 18y old] incr. from -2.25 to -3.50D; "Second scholar in the class",[starting at 17y old] incr. from 1.5-1.75D. See also: 1. E.B.Dunphy, et al ,1968. 2. B.Kinge & A. Midelfart, 1999.

[114] If Bez, et al, data has students birth month & exam date, it can be used to find rate of increase in myopia in different educ. programs, seasons - or possibly months. see footnote 17-A.

[115] A recent study with complex design found -0.46±0.15D/y; incl. data for those with only elementary up to post grad. educ. & 17y of school. G. Cuellar-Partida, S. MacGregor et al, 1/'16 .

With 85% myopic,[§7.1.a] ~11% of all of them would be expected to be worsening at that rate; with 5.8% at ≥0.7D/y and 2.8% at ≥0.8D/y.[116,117]

Of the 15 with non-zero values[118], 6 have average rates of worsening of at least one eye ≥-0.5D/y. The average rate of worsening for the most rapidly worsening eye of each of these 6 students is -0.62 ±0.06D/y, with a range of -0.50 to -0.67D/y.[119]

5.7 Shuckling

Though shuckling has been cited as a possible contributor to the high rate myopia of yeshiva students [120A,B], I have not yet seen any studies that support this idea. Six students in a row[121] in the "with glasses group" were asked or volunteered information about shuckling. Four said they shuckled, one said he didn't shuckle and one said he shuckled "a bit". Tho' the sample is small, the results look significant. B-18, the one who didn't shuckle, had the highest rate of worsening of the 6: 0.625D/y. It's the only rate of the 6, >0.57D/y [the mean+1sd for the 18 with data[112]]. The next highest rate of the 6 – among the 5 shucklers, is 0.46D/y and the mean for these 5 is ~0.2D/y. We can do a comparison of proportions for the fraction of the two groups >0.57D/y: 1/1:0/5, p=0.0143.[122] This suggests that shuckling may actually be beneficial in curtailing myopia!

However: *a.* most rates of change of worsening for these 6 involved some estimation; *b.* shuckling among those who shuckled was variable; *c.* the one who is not shuckling also has zero DVB; *d.* one of the shucklers also has unbalanced vision; *e.* there is no shuckling data for the non-myopes. This result should be seen primarily as an invitation to a more careful study of this question.
There's no mention of shuckling in connection with myopia in China, Korea and Japan – each of which has among the highest rates of myopia in the world.

5.8 Information on Eye-Health

15 students in the 'with glasses' group were asked if they were given any information on eye health. 9 said Yes; 6 said No. For those who said they received eye health advice:

SUMMARY

NUMBER OF REPORTS	ADVICE
4	Don't read in the dark.[123]
3	Don't hold book too close.[124] One was given a minimum distance amounting to ~0.4 m.[125]
2	Eat yellow/orange vegies; one of these adding fruits [126A]
1	Don't strain eyes.

None reported any advice on looking at a distance or taking eye–breaks of any type. One student in the "no glasses" group, A-18, reported his eye doctor telling him to look at a box in the corner of the office. But this student said he took no breaks at all. For both myopes and non-myopes, except for the no-breaks-retzifus ideal, almost all eye-break behavior appears to have been spontaneous.[126-B]

6.0 ANALYSIS

This includes sets of calculations with and without estimated and/or other types ambiguous data. It also includes calculations with and without the data of one student, B-20, who was both self-selected[127] and outside the "Early 20's" target age range. The first analysis is based on probability weighted values in each uncertain case.[239,247] The best overall estimate of the value of DVB may be arrived at by assigning

[116] Mean+1sd=0.3155+0.2468=0.5623D; t score=(.6D-.3155D)/0.2468D = 1.153. Based on t distr. for (18-1)=17 degr. of freedom, 13.25% of myopic Yeshiva students will have worsening of ≥0.6D. _____ With 85% of Yeshiva students myopic, 0.1325×.85=11.3% of all Yeshiva students are likely to have ≥0.6D/y rate of worsening. Similarly: (.7D-.3155D)/ 0.2468D=1.5579 t score; 6.9% myopic students & 5.8% all students≥0.7D; & (.8D-.3155D)/ 0.2468D=1.963= t score; 3.3% myopic students & 2.8% all students ≥0.8D.

[117] Highest myopia worsening rate found=0.86D/y from age 8 to 9y for 75th %ile in worsening. Seung Il Jung, Dae Hee Kim, et al , 2016

[118] Of the other 6 students in this group, B3 & B19 no rate data; B4 transf to "no glasses"; B8 & B16: Refusal; B20: 26 yrs old & ambiguous data on rate.

[119] B5,B6,B7,B11,B18,B22 https://www.calculator.net/standard-deviation-calculator.html?numberinputs=0.875%2C+0.75%2C+0.875%2C+0.875%2C+0.875%2C+0.625&x=Calculate

[120] A. David Berson, Jewish Press 6/29/90. Article doesn't cite data that shuckling is bad but only a study 8y before showed Yeshiva students 2× as likely as young men of same age in intensive secular high school to have myopia, 8× as likely to be "severely myopic". B. See footnote 96 on extreme myopia rate among teenage students in Egypt before 1948. There were ~ 75,000 Jews in Egypt at that time – probably making up a large fraction of the students in "preliminary school".

[121] Students B-13 to B-19; B-16 refused to be interviewed.

[122] A. Calc. at: _____. B. Mean worsening rate for the 5 = -0.196±0.174D/y =2.466Σ from -0.625D/y. However, with a sample of 5 & only 4 degrees if freedom, it needs ~2.776Σ for a 95%, 2 tailed, confidence level.

[123] A. The brighter the light, the smaller the pupil & stronger the signal to noise ratio. Both make it easier to read at a distance. B. Reading in the dark – with bright page & dark surroundings, gives little chance to take breaks for sharp, distant focus – a situation which this study shows is associated with worsening myopia. This effect of reading in the dark was noted by Jeff Kreps [Minn.,MN] at the Shabbes table of R. Yaakov Yehoshua Zaks, after hearing this study's results.[Mishpatim,5780, Jerus., 2/22/20] C. Such breaks would not be needed for reading in dark with a P.R.- which sets the image distance at 2-20 meters. [30]

[124] Reading distance[rd]<30cm. increased likelihood of myopia by a factor of 2.5 (CI:95:1.7–4.0)P<0.0001 in 2,339 12y old Australian school children in multivariate analysis. Table 5 p 2908, Ip, et al, see footnote 12-F

[125] 40cm ≈avg. preferred rd for adults for 10 or 12pt type, handheld, printed docs. D.H.Schuster, et al, 1969. With rd decoupled from hands & same doc. taped to vertical screen, avg pref rd incr. for 12 pnt type to 65.4cm [equiv. to 54.5cm for 10pnt type of same angular size.]A. Hartwig, et al, 2011

[126-A] "Numerous studies have identified …[the] carotenoid pigments that impart yellow or orange color to various common foods such as cantaloupe, pasta, corn, carrots, orange/yellow peppers, fish, salmon and eggs. …[as important for]…health of the eye, …[based on] epidemiological, clinical and interventional… [methods]. They constitute the main pigments found in the yellow spot of the human retina which protect the macula from damage by blue light, improve visual acuity and scavenge harmful reactive oxygen species. They have also been linked with reduced risk of age-related macular degeneration (AMD) and cataracts." El-Sayed M. Abdel-Aal et al, 2013

B It isn't clear if the unusually long and regular breaks self-selected student B-24 : 90 sec 4 times per hour -- were spontaneous or deliberate. He did not suggest that he was told to do this, that it was his own idea or that it was spontaneous. This student was also the only statistical outlier.

[127] Students were selected at times & places where they weren't expected to be studying & were expected to be wearing glasses if needed.

THE FOLLOWING CODES WILL HELP IDENTIFY WHICH CATEGORY EACH STUDENT IS IN :

A- or B- before one or more numbers indicates that those numbers that follow are from Table A: no myopia, or Table B: myopia

Italics: Ambiguous DVB data: Probability weighted value is used[239,247]. Calculations with less likely values are shown in sect. **6.2.iii**

Underscore: Student is myopic but had no change in his myopia in the past year.

TYPEFACE

Normal, **Black** and **Ultra bold**

N or N or *N* ≤ 25 sec/h DVB

N or N or *N* > 25 ≤45 sec/h DVB

N or N> 45 sec/h DVB

SUPERSCRIPTS. indicate as follows:

N^{F}	Myopia Free Family
N^{POLSS}	Possible Outlier- also Self Selected
N^{U}	Unbalanced Vision [UV]
$N^{U?}$	UV?: not asked – but most likely does not have UV.
$N^{U!}$	UV: almost certainly asked & said No – but answer was not properly recorded: ≥95%–does not have UV.
$N^{W?}$	Worsening data not recorded but probably has some worsening.

probability distributions to each point of uncertainty and then running a Monte Carlo simulation.

6.1 Comparing Means & Proportions of DVB for effects DVB on Worsening of Myopia. 'Means' aren't influenced by choice of an "Apparent Effective Dose" [AED] of DVB per hour but are influenced by those who have DVB 2 or more times higher than the minute per hour dose presumed to be effective in most cases. **§ 6.1.g, h** compares means & proportions on either side of 45secDVB/h. **§ 6.2.i** uses advanced probabilistic weighting. **§6.2.ii** has Comparisons including self-selected student B-20.

The following paragraphs, **a-h** show the process of isolating the relationship between ≥45sec/h DVB and zero Worsening of Myopia[WM] from some other known factors that influence WM. The other factors whose influence is reduced in this process include: known Genetics [paragraph **b**]; presence of myopia without WM [paragraphs **c** & **d**]; known Unbalanced Vision [UV] [par. **e**]; No data on WM [par. **f**]; Possible – but unknown - UV [par. **g**]; and exclusion of an extreme outlier [paragraph **h**].

a. Mean log weighted DVB for 14 that have DVB data & who have No Myopia:[128] N=14

a.I Log value= 1.632±0.956
Anti-Log =42.85 sec/h

Mean log weighted DVB for 19 With Myopia and DVB data:[130]

a.II Log value 0.7966±0.8314[131]
Anti-log =6.260sec/h

Comparison of means: a.I & a.II : P=0.0117[132A]
Comp. of proportions:10/14:2/19 : P=0.0034[132B]
OR: 10:4/2:17 = 21.25; 95% C.I.: 3.28 to 137.67[132C]

b. Mean log weighted DVB for 13 with no myopia, excluding one student [A-13][133] with MF [=Myopia Free Family: both parents & all siblings with both no myopia & no Unbalanced Vision [UV].][134] N=13

b.I Log value = 1.758±0.867[135]
Anti-Log =57.2 sec/h

Comparison of means b.I & a.II: P=0.0036[136]

c. Mean log weighted DVB for 16 with no myopia, No MF or no WM [=Worsening of Myopia in past year] This adds 3 students from Group B that had no Worsening of Myopia in the past year to the remaining 13 with no myopia & no MF in Group A[137], N=16

c.I Log value 1.685±0.896[138]
Anti-Log=48.2

d. Mean log weighted DVB for those 16 with presumed WM in the past year [These are the 16 left in group B after subtracting those 3 with no WM -- the same 3 included in the 16 above, at c.][There are none with known UV in this group as the only student with known UV, B-14, has no WM.] [Two

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[128] A-1$^{U?}$,2$^{U?}$,5, 12^{U},13^{F},14^{U}, 16^{U},18,19$^{U!}$, 20,22,23, 24,26 N=14

[129] Standard deviations shown & used in this analysis are "sample standard deviations" which are larger & produce higher P values than the "population standard deviation". The higher the P value, the less significant the result. The "sample standard deviation" here =0.956, the "population standard deviation"= 0.922. https://www.calculator.net/standard-deviation-calculator.html?numberinputs=1.778%2C+1.778%2C+1.778%2C+2.556%2C+0%2C0%2C2.255%2C0%2C+1.778%2C+++2.255%2C+1.301%2C+2.556%2C+2.301%2C2.512&ctype=s&x=56&y=13

[130] B-1,2,3$^{W?}$, 5,6,*7*, *10*,11,*12*, 13,14^{U},*15*, *17*,18,19$^{W?}$, 21,22,23, 24^{POLSS} N=19

[131] https://www.calculator.net/standard-deviation-calculator.html?numberinputs=0%2C0%2C0%2C+0%2C+0%2C+1.477%2C1.176%2C0.301%2C1.176%2C0.301%2C+0.176%2C0.778%2C+1.477%2C+0%2C+0.602%2C+1.462%2C+1.176%2C2.477%2C2.556&ctype=s&x=66&y=16

[132] [All P's are 2 tailed] **A.** https://www.medcalc.org/calc/comparison_of_means.php **B.** https://www.socscistatistics.com/tests/ztest/default2.aspx **C.** OR is Odds Ratio, a standard measure used in the 6 prior myopia studies cited. [See p 4, Table]. C.I. means Confidence Interval. The smaller the sample size, the wider the 95% C.I. spread. https://www.easycalculation.com/statistics/odds-ratio.php

[133] The student was asked if his eyes worked together & replied that they did. He wasn't asked specifically about stereo vision – which I wasn't aware of as an issue at the time – & he wasn't asked if the eyes of his parents & siblings worked together. [These details were also not explicitly asked of any other students who are described in this study as having no UV. B-14 is understood to have no stereo as a result of the 3 diopter spread between prescriptions for his two eyes.] A-13 didn't volunteer any more information along these lines -only adding that some cousins did have myopia.

[134] A-1$^{U?}$,2$^{U?}$,5, 12^{U},14^{U},16^{U}, 18,19$^{U!}$,20, 22,23,24, 26 N=13

[135] https://www.calculator.net/standard-deviation-calculator.html?numberinputs=1.778%2C+1.778%2C+1.778%2C+2.556%2C+0%2C2.255%2C0%2C+1.778%2C+++2.255%2C+1.301%2C+2.556%2C+2.301%2C2.512&ctype=s&x=56&y=21

[136] https://www.medcalc.org/calc/comparison_of_means.php

[137] A-1$^{U?}$,2$^{U?}$,5, 12^{U},14^{U},16^{U}, 18,19$^{U!}$,20, 22,23,24, 26 ,B-14^{U},21,23 N=16

[138] https://www.calculator.net/standard-deviation-calculator.html?numberinputs=1.778%2C+1.778%2C+1.778%2C+2.556%2C+0%2C2.255%2C0%2C+1.778%2C++2.255%2C+1.301%2C+2.556%2C+2.301%2C2.512%2C+0.176%2C1.462%2C2.477&ctype=s&x=61&y=17

students B-3 & B-19 in this group have no WM data and are only presumed to have WM like the majority in the group. In group 'f', below, they are removed.][139] N=16

d.I Log value = 0.689±0.757[140]
Anti-Log = 4.88sec/h

Comparison of means: c.I & d.I: P=0.0019

e. Mean log weighted DVB for those 12, at 'c' above,[no myopia, No MF or no WM in past yr] minus all 4 from A or B with known UV[minus:A-12[U],14[U],16[U],B-14[U]].[141] N=12

e.I Log value = 1.831±0.713[142]
Anti-Log mean= 67.76sec/h

Comparison of means: e.I & d.I: P=0.0004

f. Mean log weighted DVB for 14 students from group 'd' with known WM & DVB data. [excludes 2 from group 'd', B-3[W?],19[W?], who don't have known WM data[143]. N=14

f.I Log value mean=0.744±0.788[144-A]
Anti-Log mean = 5.548 sec/h
Medians: 2 & 6; Mode: 0 sec/h
Range 0-360sec/h

Includes Self-Selected Outlier B-24[POLSS]=360 sec/h=24.5% of DVB time in log units & 75.8% of all real [or anti-log] sec/h. It's also 60× the higher median. Outlier for real values.[144-B]

Comparison of means: e.I & f.I: P=0.0012
ODDS RATIO 9:3/1:13

This figure excludes effects of known UV, known MF and presumed but not known WM. [It should be noted that while B-19 has a very low level of myopia and may have an even lower increase in myopia or none, B-3 has an above average level of myopia and a very low level of DVB, suggesting very likely an increase in myopia.]

It doesn't exclude effects of 2 possible UV cases, A-1,2, who weren't asked about UV. Since there were 5 in the "No Myopia" group who had UV, of 15 non-myopes who volunteered that they had UV[A-8,9] or were queried on it [A-5,8,9, 12,13,14, 16,18,19? 20,22,23, 24,25,26] [145], the chances are $(10/15)^2$ or 44.4% that neither has UV. It's somewhat more unlikely considering the readiness with which 3 students not queried on this volunteered they had it. There is also a 15th student, A-19, whose record doesn't explicitly show he had no UV – but who was transferred from the "Myopia Group" – where everyone was asked. Since A-1 and A-2 have the same DVB total, excluding either one of them would give the same somewhat conservative result in a comparison of means:

g. Excluding A-1[U?] who may have UV- although it's unlikely- & retaining A-2[U?]- who would very likely not have UV if A-1 had it - & also including A-19[U!], who, intuitively, has ≤5% likelihood of UV.[146] N =11

g.I Log value 1.836±0.747[147]
Anti-Log mean = 68.58sec/h
Median: 60; Mode: 60 sec/h
Range: 0-360 sec/h

Comparison of means: g.I & f.I: P=.0018
Odds Ratio 8:3/1:13 34.7, 95%CI 3.1 to 393.2[132C]

This would ordinarily be the most plausible case for the effects of DVB alone - uncomplicated by known family resistance to myopia & UV. However, as already noted, group f contains a selfselected outlier: B-24[POLSS].[148]

h. Without the outlier, B-24[POLSS], we have the most representative set of myopes with DVB data & other factors excluded to the extent possible at this stage[149]. N=13

h.I Log value mean= 0.605±0.615[150]
Anti-Log mean= 4.025 sec/h
Median =2.0 sec/h; Mode = 0 sec/h
Range 0-30 sec/h

COMPARISON of MEANS g.I & h.I P= 0.0002

COMPARISON of PROPORTIONS for same two groups g.I & h.I for those having >45sec/h DVB
8/11:0/13=0.7272:0.000
P= 0.0002
Fisher Exact Test P= 0.00022435
ODDS RATIO 8:3/0:13 [needs non-0 values[132C]]

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[139] B-1,2,3[W?], 5,6,*7*, *10*,11,*12*, 13,*15*,*17*, 18,19[W?],22, 24[POLSS] N=16

[140] https://www.calculator.net/standard-deviation-calculator.html?numberinputs=0%2C0%2C+0%2C+0%2C+1.477%2C1.176%2C0.301%2C1.176%2C0.301%2C0.778%2C+1.477%2C+0%2C+0.602%2C+1.176%2C2.556&ctype=s&x=43&y=9

[141] A-1[U?],2[U?],5, 18,19[U!],20, 22,23,24, 26,B-21,23 N=12

[142] https://www.calculator.net/standard-deviation-calculator.html?numberinputs=1.778%2C+1.778%2C+1.778%2C2.255%2C0%2C+1.778%2C++1.301%2C+2.556%2C+2.301%2C2.512%2C+1.462%2C2.477&chtype=s&x=47&y=18

[143] B-1,2,5, 6,*7*,*10*, 11,*12*,13, *15*,*17*,18, 22,24[POLSS] N=14

[144] A https://www.calculator.net/standard-deviation-calculator.html?numberinputs=0%2C0%2C+0%2C+0%2C+1.477%2C1.176%2C0.301%2C1.176%2C0.301%2C0.778%2C+1.477%2C+0%2C++1.176%2C2.556&ctype=s&x=54&y=14

B.1,1,1,1,30,15,2,15,2,6,30,29,15,360 https://miniwebtool.com/outlier-calculator/ https://miniwebtool.com/interquartile-range-calculator/ Data arranged to show quartiles: 1,1,1,1,2,2,6, 15,15,15,29,30,30,360;N=14; [29-1]=28; × 3=84; 360 >[29+(3×28)] defines it is a "strong outlier"; ~ method of J.W. Tukey, '77.

[145] There were 4 queried on UV who didn't give DVB data but were understood at the time to be non-myopic. However, it appears that one of these, A-6, is now both UV & myopic & should be excluded from this count. I also think he's older than the other students & doesn't have their religious study background. He wasn't asked about DVB after he volunteered he had UV. The record of A-19 doesn't explicitly show he had no UV – but he was transferred from the "Myopia Group" – where everyone was asked.

[146] A-2[U?],5,18, 19[U!],20,22, 23,24,26,B-21,23 N=11

[147] https://www.calculator.net/standard-deviation-calculator.html?numberinputs=+1.778%2C+1.778%2C2.255%2C0%2C++1.778%2C++1.301%2C+2.556%2C+2.301%2C2.512%2C+1.462%2C2.477&ctype=s&x=51&y=17

[g.I : If the same data are entered 20 times each, N=220 & sd drops from 0.747 to 0.714 [using "sample" calculation instead of "population"]. With "population" sd = 0.7126 for both N=11 & N=220.

[148] Student was self-selected in the course of a discussion related to this study after I'd ended data collection & completed most of the analysis. He said his pattern of DVB refutes my results – so I interviewed him & included him in this study. As already noted, he may represent a case where a large amount of DVB partly offsets a strong genetic tendency toward very high myopia. For more on this student see footnote 87 & pages 15 & 16

[149] B-1,2,5, 6,*7*,*10*, 11,*12*,13, *15*,*17*,18, 22

[150] https://www.calculator.net/standard-deviation-calculator.html?numberinputs=0%2C0%2C+0%2C+0%2C+1.477%2C1.176%2C0.301%2C1.176%2C0.301%2C0.778%2C+1.477%2C+0%2C++1.176&ctype=s&x=57&y=16

Same data entered 20 ×, N=260, sd drops from 0.615 to 0.5923 where both use "sample" calc.; using "population" both = 0.5912. Comparing means using "population" sd's P<0.0001; using original "sample" sd's in both cases, P<0.0001; Comparison of proportions with 10 × increase in sample size, P<.0001.With simulated data, use original sample size as a sum since each simulated data point is actually only a fraction of the original.

The P values for COMPARISON OF MEANS & PROPORTIONS are identical for these 2 groupings at 0.0002. As the groupings are based on the most plausible exclusions to reliably isolate the associations between what was anticipated would be an effective dose of DVB & WM, this is a very good, indicator that ≥60 sec/h of DVB is strongly associated with no WM and the results did not occur by chance.

i However this figure still contains:

1 some small- but possible- protective influence of UV in A-2$^{U?}$ and A-19$^{U!}$, and

2 possible protective genetic influences in A-18 & A-22.

3 It also fails to allow a plausible influence of 18-40sec/h DVB in producing 0 worsening in the special situation of extreme myope A-21.

The following computes the effects of these factors and refines the analysis of ambiguous data using probabilistic weighting.

6.2.i Probabilistic weighting of data seen to have a range of possible values. **See 6.2.i.u,** below.

a. Smallest known probability = 5%, that A-19$^{U!}$ has UV.[146] Thus, 20 simulation points are used for each ambiguous data element.

b. There's also a ~5% chance B-14 does have stereo vision & thus doesn't have UV. Since B-14 has no WM, this 5% should be kept in the group. Log = 0.176; Add 1 to 220

c. In 19 simulation points, A-19$^{U!}$ is 60sec. In 1, A-19$^{U!}$ is removed from the DVB analysis to isolate it from UV.

d. For A-1$^{U?}$ & A-2$^{U?}$: Of 40 possibilities for these 2, assume [3/13]×40≈9 are removed from DVB analysis to isolate it from UV.[151]

e. A-18 & A-22: possible genetic influence[152]. Of the sum of 40 for these two, assume 27 are present & 13 are excluded from DVB analysis to isolate it from genetic influences Exclude 6 from A-18 & 7 from A-22.

f. Assume B-21, with 0 worsening, & put in the NO WM Group, has 6 of 20 just >45sec/h cut off: 46 sec/hDVB[$\log_{10}$=1.663]& 14 of 20=21.7sec/h [$\log_{10}$ =1.336], [This keeps the mean of B-21 at 29 & leaves the avg. of the 222 in group unchanged]. This allows for the possibility that extreme myopia needs less DVB to stop it from getting worse. [Tho' B-24 apparently requires much more DVB with moderate myopia to keep his myopia from worsening more rapidly.]

g. Assume weights for 4 ambiguous values in WM group are (1×16)+(2×17)+(6×20)+(5×30)+ (3×40)+ (2×50) +(1×60)=600; 20 =∑ of weights;600/20=30; =1.5×single best guess. Logs of sec/h numbers are: 1.204,1.230, 1.301, 1.477, 1.602,1.699, 1.778,

h. Weights are same for all 4, but the weighted values are 1/2 as much for 2 of them.[64] (1×8)+ (2×8.5)+(6×10)+(5×15)+(3×20)+(2×25)+(1×30)=300; 20=∑of wts; 300/20=15;=1.5×single best guess. The log values of these sec/h numbers are: 0.903,0.929, 1.000, 1.176, 1.301, 1.398,1.477

i. Assume that B-15 [with 80% probability he is looking at his cellphone and 20% he is looking at distance] has 0 sec/h DVB for 16 out of 20 and 30 sec/hDVB for 4 out of 20.

j. There are 2, B-3$^{W?}$ & B-19$^{W?}$ with no WM data in Table B and 20 with current prescription data [excl. B-20 [too old + ambiguous]. Of these, B-14^{U} has UV and B-24^{POLSS} is an outlier. This leaves 16 'normal' with WM data, 2 of which, B-21 & B-23 have 0 WM. Add 2/16 × 40 = 5 to NO WMG & 35 to WMG. However, B-3$^{W?}$ & B-19$^{W?}$ aren't equal, with logs=0 & 0.602, & can't be treated identically. Since B-19 with a low prescription he didn't know, is more likely to have 0 WM, put 2 from B-3$^{W?}$ & 3 from B-19$^{W?}$ into NO WMG & 18 from B-3$^{W?}$ & 17 from B-19$^{W?}$ in WMG.

k. Adding A-1$^{U?}$+1/8th[B-3$^{W?}$+B-19$^{W?}$],+5%B-14,# MU [Model Units] in NoWMG increases by 20+ 2+3+1=26, but from counting some as partially present, [1+9+6+7]=23 are subtracted, so # present increases from 220 to 223 MU &11.15 full subjects for No WMG. The number with WM is increased by 18+17, [from B-3$^{W?}$ & B-19$^{W?}$] from 260 to 295 MU and 14.75 full subjects.

l. However, both comparison of proportions & means & Fisher exact test must use integers. If the integers used are close to but less than the actual integers, the P values will be higher [more probable] & thus, conservative.

m. As those 4 who have 60sec/h actually have distributions where 3 of them clearly include 40sec/h, assign a distribution to these 4; 1 of 40; 2 of 50; 4 of 56; 6 of 60; 4 of 66, 2 of 75; 1 of 90; Insert log 40=1.602 and log 90= 1.954 of all 4 of these in lines 1&2 of the simulated data table.[40 & 90 offset each other in the mean & the 4 40's are added to <45 range to be counted in the comparison of proportions.

n. Multiply sample standard deviations by 1.04 to compensate for the effect of the number of data elements in sample on sample s.d.

o. FOR WORSENING MYOPIA GROUP:
Count, N:295;Sum,Σx:155.01;Mean:μ: 0.5255; antilog: 3.353; [Sample]Stand. Dev., s: 0.590× 1.04=0.614[use in comparison as true sample size: 11-15, not 220-300] Median 0.301; Mode = 0; # >45 = 6; % <45= 6/295= 2.03%[153]

p. FOR NO MYOPIA WORSENING GROUP:
Sample Stand. Dev, s: 0.68644×1.04=0.7139 [use in comparisons];Count,N:223;Sum,Σx : 414.057;Mean:1.857; antilog=71.905 Median & Mode: 60; # >45: 223-51=172=77.13%[154]

q. COMPARISON OF MEANS with adjusted Sample S.D. ;using 11 & 14 for sample sizes: P < 0.0001 [P = 0.0001 11 &13; true sample size is 14.75][155]

[151] 3 out of 13 queried on UV had UV, 2 more volunteered that they had it – but no DVB data, 1 more volunteered but may be too old & now has glasses for strabismus. So 10/15 have no UV & 3/13 of those queried, have UV.

[152] Assume from A-13 having MF, A22 not asked about family and A-18 has a father with -13D myopia while a large fraction of his numerous adult siblings have none-- that at least 1/3 of those with such low numbers are genetic.

[153] See text box p 25, lower left for data array with 295 entries for WORSENING MYOPIA [WM] GROUP.

[154] See text box p 25, lower right for data array FOR NO MYOPIA WORSENING GROUP

[155] A. https://www.medcalc.org/calc/comparison_of_means.php
B. https://www.medcalc.org/calc/odds_ratio.php 2:10 vs 14/14

r. COMPARISON OF PROPORTIONS same data: P = 0.0001; [P<0.0001 if N increases from 11 to 16]

s. FISHER EXACT TEST using nearest lower whole number: 8:2 & 0:14, P= 0.00006119.]

t. ODDS RATIO: 162.4 , 95% CI 3.37 to 7836[155-B]

u. MONTE CARLO METHODS should be used for greater accuracy in handling some uncertainties. To be a bit conservative, use P<.0002.

6.2.ii Comparisons including self-selected & unusual students: B-20 & B-24.

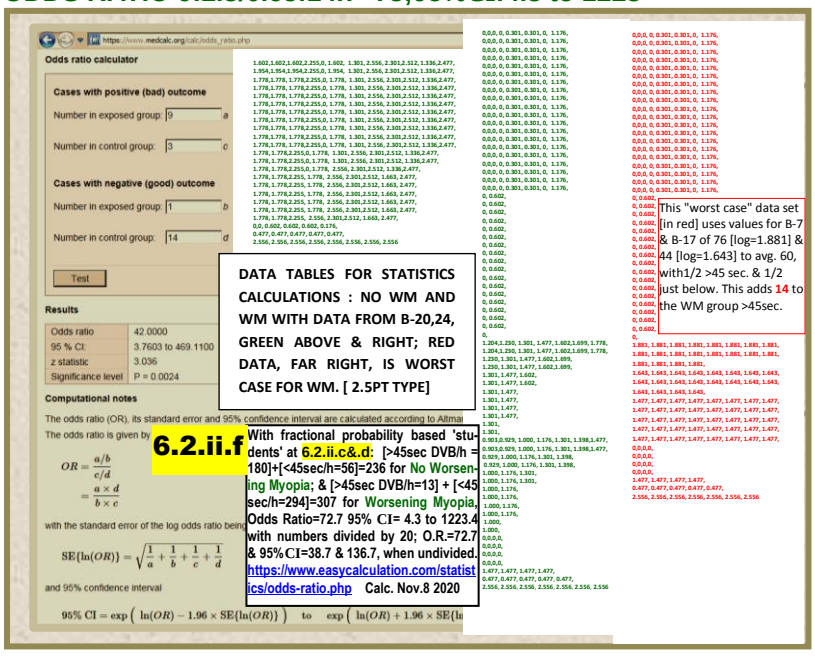
a. B-20 [3 [0.477] sec/h DVB; -8.5D[252]]is 1. self-selected; 2. 26 -outside age range for this study; & 3. Ambiguous- not clear if he had WM or not. For a 1st approximation, we'll deduct 1/4th for being self-selected[156] and another 1/4th for being outside the range. We will take the remaining half and divide it between the WM and No WM groups. Add 5 with log 0.477DVB sec/h to WM & 5 with log 0.477 to No WM.

b. B-24 [360 [2.556]sec/h DVB; -3.75D] is 1. self-selected; & 2. an outlier within the WM group. It appears, however, that he's an example of strong genetic pressure for high myopia, [father has -11D &-12D] offset in part by high DVB. He has <1/2 the rate of worsening & lower than avg. myopia of the WM group. We'll deduct 1/4th for being self-selected and divide the remaining 15 with 7 [2.556] in WM [to reduce outlier effect] and 8 [2.556]in No WM.

c. No WM. 223+5+8=236;Σx=436.89; s.d.=0.709×1.04=0.737; mean=1.851±0.737; anti log:70.99; median & mode 60; %>45 sec.[log 1.653]180/236=76.27%

d. WM. 295 +5+7=307; Σx=175.287; s.d.=0.653×1.04=0.679 mean= 0.571± 0.679; anti log:3.72; Median 0.301; Mode = 0; %>45 sec=13[=6+7 from B-21[6.2.i.f]& B-24[6.2.ii.b],resp.] /307=4.23%

e. COMPARISON OF MEANS [incl. B-20 & 24];n=12 & 15 P=0.0001; COMPARISON OF PROPORTIONS P=0.0001 FISHER EXACT TEST 9:3 · 1:14; p=.00075; however, the actual % is much <1/14; with 1:17 p= .000134; with 1:18 p= 0.0000957; 4.23% would be 1:22.6; ODDS RATIO 9:2.8/0.65:14.7=73;95%CI:4.3 to 1223[157]


Odds ratio calculator
Cases with positive (bad) outcome
Number in exposed group: 9
Number in control group: 3
Cases with negative (good) outcome
Number in exposed group: 1
Number in control group: 14
Test
Results
Odds ratio 42.0000
95 % CI: 3.7603 to 469.1100
z statistic 3.036
Significance level P = 0.0024
Computational notes
DATA TABLES FOR STATISTICS CALCULATIONS : NO WM AND WM WITH DATA FROM B-20,24, GREEN ABOVE & RIGHT; RED DATA, FAR RIGHT, IS WORST CASE FOR WM. [2.5PT TYPE]
This "worst case" data set [in red] uses values for B-7 & B-17 of 76 [log=1.881] & 44 [log=1.643] to avg. 60, with1/2 >45 sec. & 1/2 just below. This adds 14 to the WM group >45sec.
6.2.ii.f
With fractional probability based 'students' at 6.2.ii.c&.d: [>45sec DVB/h = 180]+[<45sec/h=56]=236 for No Worsening Myopia; & [>45sec DVB/h=13] + [<45 sec/h=294]=307 for Worsening Myopia, Odds Ratio=72.7 95% CI= 4.3 to 1223.4 with numbers divided by 20; O.R.=72.7 & 95%CI=38.7 & 136.7, when undivided. https://www.easycalculation.com/statistics/odds-ratio.php Calc. Nov.8 2020

6.2.iii Worst case: results of 6.2.ii but substituting extreme values 60 & 30sec/h for 4 students with unclear DVB values :B-7,17,10&12.

a.N=307,Σx=201.539, s.d.=0.7514×1.04=0.7815. Mean= 0.656 ±0.712; antilog=4.53sec; Median 0.301; Mode 0; %>45sec = [13 from 6.ii.d + 14 new from B-7,17[see red text box][64]=27]; 27/307=8.79%[compare with 6.2.ii.d] b. COMPARISON OF MEANS[with 6.2.ii.c]:P=0.0002 https://www.graphpad.com/quickcalcs/ttest2/ ; c. COMP OF PROP.:2/23&9/12, P<0.0001;1/11&10/13, P=.0009; tru value is between these – requires integers. e. ODDS RATIO: 180:56 & 27:280; =33.333 95% CI:3.6 to 306.3 using 9:2.8 & 1.35:14.0, OR remains same https://www.easycalculation.com/statistics/odds-ratio.php

6.3 Analysis of the effects of Unbalanced Vision [UV] on Myopia Worsening

It has already been noted – §5.3, supra, that UV occurs disproportionately among those who don't have any myopia. Here we will try to isolate the effects of UV.

There are only two students in this small Pilot Study who have UV and also don't have either:

1. an apparent effective dose of DVB [DVB>45sec/h], or
2. a known Myopia Free Family [MF]

These 1.95 are A-14U & 95% of B-14U. [158] Neither of these have Worsening Myopia.

Of those who don't have UV and also don't have either of the two criteria mentioned above, 2.05 have no worsening myopia: A-18 & A-22 and 5% of B-14. A-18 & A-22 have no myopia at all. However, we have assumed above, [at §6.2.i.e] that A-18 & A-22 combined, have a 1/3 likelihood of having direct genetic protection. So we have only 1.333 [not 2]+ 0.05 from B-14=1.383. Fourteen more have known worsening: B-1,2,5, 6,*7,9* 10,*11,*12, 13,*15,17*, 18,22. [B-9* has been included because DVB data is known to be <45 sec/h – & ≤30sec/h but exact value is not known.]

Two others, B-3[0 sec/h] & B-19[4s/h] have no rate of change data, but, at §6.2.i.j,k,l **Probabilistic weighting of data**, following the pattern of the other 16, have been assumed to be 1/8th "No WM" [which has been transferred to the No WM group] and 7/8ths with WM.

So we can do analysis of proportions: 1.95/1.95:[1.333+0.05+(1/8×2)]/[14+1.333+0.05+2]= 1.633/17.383 = 100.0%:9.39%; P = 0.0026[159]; Fisher Exact Test P=0.035[160] [using 2,0 & 2,15] [Using [2,0 & 1,10] or [2,0&2,20] Fisher Exact P= 0.0385 & .0217] This is the more appropriate test; true value ~P=0.03. Tests aren't exact: integers are required and the true relations involve non-integer values.]

We can also compare DVB time of these groups [less B-9*] – tho' we know in advance that all have less than an apparent effective dose of 45sec/h.

[156] Among those who were not myopic, I tried to interview every student without glasses that I saw during non-study periods. For those with glasses, I tried to interview them primarily at times and places where I interviewed most of the students without glasses.

[157] https://www.medcalc.org/calc/odds_ratio.php

[158] B-14 has 95% likelihood of no stereo -assumed to mean 95% likelihood of UV. This factor is included in the main probabilistic analysis: see §6.2.i

[159] https://www.medcalc.net/statisticaltests/comparison_of_proportions.php

[160] https://www.medcalc.net/statisticaltests/fisher.php

Calc. at **A** based on 20 units/student to enable shifting position of parts of an individual student based on probabilities as low as 5%, in increments of 5%. **B** is based on 2 units/student. **C** is based on actual number of students—after probabilistic shifting. Numbers of students & student fractions in each category are taken from section **6.2.ii**, prev. page. The O.R. remains the same in each case, but with smaller sample sizes, the 95% CI increases dramatically – as expected. Note that the lowest confidence level has a 2.5% probability that it will be ≤4.3 – ~2× actual O.R. for other studies shown in the table on p. 4 of this report. As there is more than one relevant data element/student – including ranges of DVB provided by individual students – true number of units/student is probably greater than one & closer to 2 – so 95% CI at B, above, is probably closer to the reality.

Fig. **D** shows what happens to the 95% CI range when numbers are closer to what is found in 6 studies cited in the table on p. 4 of this report.
Figure **E** shows the calculations based on original numbers – before adjustments for UV, Genetic contribut., Outliers, etc. It corresponds to **6.1. a.I & a.II.**
Figure **F** is after adjustments – but still including the self-selected outlier. It corresponds to **6.1. e.I & f.I.**

SOME CLARIFICATIONS OF ODDS RATIO CALCULATIONS

CALCULATIONS ABOVE CARRIED OUT NOV 8-10, 2020, AT: https://www.easycalculation.com/statistics/odds-ratio.php

0,0,0, 0, 0.301, 0.301, 0, 1.176,
0,0,0, 0, 0.301, 0.301, 0, 1.176,
0,0,0, 0, 0.301, 0.301, 0, 1.176,
0,0,0, 0, 0.301, 0.301, 0, 1.176,
0,0,0, 0, 0.301, 0.301, 0, 1.176,
0,0,0, 0, 0.301, 0.301, 0, 1.176,
0,0,0, 0, 0.301, 0.301, 0, 1.176,
0,0,0, 0, 0.301, 0.301, 0, 1.176,
0,0,0, 0, 0.301, 0.301, 0, 1.176,
0,0,0, 0, 0.301, 0.301, 0, 1.176,
0,0,0, 0, 0.301, 0.301, 0, 1.176,
0,0,0, 0, 0.301, 0.301, 0, 1.176,
0,0,0, 0, 0.301, 0.301, 0, 1.176,
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0,0,0, 0, 0.301, 0.301, 0, 1.176,
0,0,0, 0, 0.301, 0.301, 0, 1.176,
0, 0.602,
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0, 0.602,
0,
1.204,1.230, 1.301, 1.477, 1.602,1.699, 1.778,
1.204,1.230, 1.301, 1.477, 1.602,1.699, 1.778,
1.230, 1.301, 1.477, 1.602,1.699,
1.230, 1.301, 1.477, 1.602,1.699,
1.301, 1.477, 1.602,
1.301, 1.477, 1.602,
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0.903,0.929, 1.000, 1.176, 1.301, 1.398,1.477,
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0.929, 1.000, 1.176, 1.301, 1.398,
0.929, 1.000, 1.176, 1.301, 1.398,
1.000, 1.176, 1.301,
1.000, 1.176, 1.301,
1.000, 1.176,
1.000, 1.176,
1.000, 1.176,
1.000, 1.176,
1.000,
1.000, ...
0,0,0,0,
0,0,0,0,
0,0,0,0,
0,0,0,0,
1.477, 1.477, 1.477, 1.477,

8 students left as is, but inserted 20 times

B-1, B-2, B-5, B-6, B-11, B-13, B-18, B-22

B-3W? & B-19W?

See §**6.2.i.**j

B-10 & B-12

See §**6.2.i.**g&h

B-7 & B-17

See §**6.2.i.**h

B-15, See §**6.2.i.**i

ON LEFT

DATA SET FOR

MYOPIA WORSENING GROUP

IN PROBABILITY WEIGHTED ANALYSIS

DISCUSSED AT §6.2.I

Ref. from footnote 153

.m A-1,	.m A-2,	.d,.m A-5,	.e A-20,	.m A-18,	.m A-19,	.e A-22,	A-23,	A-24,	A-26,	B-21,	B-23	SEE NOTE 6.2.i STUDENT NUMBER
1.602,1.602,	1.602,2.255,	0,	1.602,	1.301,	2.556,	2.301,2.512,	1.336,2.477,					
1.954,1.954,	1.954,2.255,	0,	1.954,	1.301,	2.556,	2.301,2.512,	1.336,2.477,					
1.778,1.778,	1.778,2.255,	0,	1.778,	1.301,	2.556,	2.301,2.512,	1.336,2.477,					
1.778,1.778,	1.778,2.255,	0,	1.778,	1.301,	2.556,	2.301,2.512,	1.336,2.477,					
1.778,1.778,	1.778,2.255,	0,	1.778,	1.301,	2.556,	2.301,2.512,	1.336,2.477,					
1.778,1.778,	1.778,2.255,	0,	1.778,	1.301,	2.556,	2.301,2.512,	1.336,2.477,					
1.778,1.778,	1.778,2.255,	0,	1.778,	1.301,	2.556,	2.301,2.512,	1.336,2.477,					
1.778,1.778,	1.778,2.255,	0,	1.778,	1.301,	2.556,	2.301,2.512,	1.336,2.477,					
1.778,1.778,	1.778,2.255,	0,	1.778,	1.301,	2.556,	2.301,2.512,	1.336,2.477,					
1.778,1.778,	1.778,2.255,	0,	1.778,	1.301,	2.556,	2.301,2.512,	1.336,2.477,					
1.778, 1.778,	2.255,	0,	1.778,	1.301,	2.556,	2.301,2.512,	1.336,2.477,					
1.778, 1.778,	2.255,	0,	1.778,	1.301,	2.556,	2.301,2.512,	1.336,2.477,					
1.778, 1.778,	2.255,	0,	1.778,		2.556,	2.301,2.512,	1.336,2.477,					
1.778, 1.778,	2.255,		1.778,		2.556,	2.301,2.512,	1.663, 2.477,					
1.778, 1.778,	2.255,		1.778,		2.556,	2.301,2.512,	1.663, 2.477,					
1.778, 1.778,	2.255,		1.778,		2.556,	2.301,2.512,	1.663, 2.477,					
1.778, 1.778,	2.255,		1.778,		2.556,	2.301,2.512,	1.663, 2.477,					
1.778, 1.778,	2.255,				2.556,	2.301,2.512,	1.663, 2.477,					

0, 0, 0.602,0.602,0.602, 0.176

B-3,	------- B-19-------,	B-14	STUDENT NUMBER
.j	.j	.b	SEE NOTE 6.2.i

ABOVE DATA SET FOR NO MYOPIA WORSENING GROUP IN PROBABILITY WEIGHTED ANALYSIS

Ref. from footnote 154

With UV: N=2
0.0, 0.176 [0 and 1 are converted to 1&1.5 before converting log values as log of 0 is undefined.[207]]
Log Avg 0.088±0.124; Anti-Log = 1.22sec/h

No UV: N=17
0,0,1.301, 0,0,0, 0,1.477,1.176, 0.301,1.176,0.301, 0.778,1.477,0, 0.602,1.176

Log Avg.= 0.574±0.599[161]; Anti-Log =3.75sec/h

Comparison of means P=0.2656

So, the difference of having or not having UV associated with protection for myopia is significant: P~0.03, while the difference between the DVB sec/h of these two groups is not significant: P=0.2656. [Probabilistic weighting of data was not used.]

7.0 DISCUSSION

7.1 It appears from the evidence of this Pilot Study, that there are at least three distinct mechanisms associated with "worsening myopia" in this group:

1. An Apparently Effective Dose [AED] of ~1 min. of [DVB]/h of intensive study. For those who already have very high myopia – like B-21- a smaller amount of DVB/h may be adequate. For those with at least one parent with very high myopia –like B-24- a larger amount may be helpful when the level of myopia is still only moderate.

2. Unbalanced Vision [UV] may interfere with the "near signal" of the eye growth mechanism.[162] If the eye growth mechanism aims for a balance between ability to see far and near, no near signal – in the presence of a far signal – may give more weight to this latter signal and the eye doesn't become myopic.

   It has already been pointed out in **RESULTS**, §5.3, that the overall number of those with UV in the no myopia/no glasses group is relatively high. There are 15 students in the group with reasonably definite UV data – if we include 3 who didn't provide information on their DVB. Of these 15, 5 definitely have UV and no need for glasses.[163] This compares with only 1 out of 18 with rate of change data in the "glasses" group or 1 of 20 if we include 2 that have no rate of change data;

   5/15:1/18, 0.3333: 0.0556, P= 0.0425
   5/15:1/20, 0.3333: 0.0500, P= 0.0301

   This is even more impressive when we consider that the 1 with UV among the glasses group, B-14, has very low average myopia of his two eyes: -0.5D, and has had no change in his myopia for at least 3 years. Further, -0.5D is usually considered borderline myopia and is the lowest of the 20 students who provided specific information on their prescriptions.

3. Genetic background includes a direct effect –where the eyes have a different mechanism for directing their growth pattern – different from the balance of near and far that is apparently used in regulating the growth of the eyes of the hatchling chicks. This mechanism may require only a few seconds of distance viewing per day to set the growth target to maintain clear distance vision and little or nothing "beyond the horizon." In this condition, the near work is not monitored by the eye-growth regulating mechanism. This may be protecting A-13 and his family.

   Other genetic contributions may independently effect UV – as with A-9, and DVB - as with A-24 – indirectly generating resistance to myopia. In some cases the genetic contribution may strongly favor myopia – as is suggested for B-24 – so that relatively high levels of DVB – or some other treatment – may be needed to combat it.

4. See text box, p.17, for discussion of a possible – but improbable-- hidden genetic effect.

7.1.a The fraction of students protected from myopia by DVB, UV and Genetics.

Two studies have shown that over 80% of Yeshiva students have myopia. Zylbermann, et al, showed 81.3% of students 14-18 years old were myopic:[17-B] Bez, et al, found 82.2% of 17-18 year olds had myopia.[17-A] This suggests a small increase in the fraction with myopia with increasing age in this general age range. For the early 20's students in this study, a reasonable round number estimate would be 85%. Based on the work of Zylbermann et al[17-B], we'll assume 5% are far sighted[164] –. This leaves 10% for the no glasses/no myopia group.

5%	**far sighted**
85%	**myopic**
10%	**no glasses -- good vision far & near in at least one eye.**

This means that each of the 14 students with DVB data in the no glasses group - **6.1a** - represents 10/14=0.714% of the "early 20's" Yeshiva student population. So A-13, the only student with a clear

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[161] https://www.calculator.net/standard-deviation-calculator.html?numberinputs=0%2C0%2C1.301%2C+0%2C0%2C0%2C+0%2C1.477%2C1.176%2C+0.301%2C1.176%2C0.301%2C+0.778%2C1.477%2C0%2C+0.602%2C1.176++&ctype=s&x=51&y=18

[162] Chickens used in studies of Prof. Wallman et al [see footnote 8] have eyes on opposite sides of their heads designed to give a constant 360° view – to be alert to possible attacks of predators from whatever direction they come. Human eyes face front & are used most of the time in ways that could achieve stereo vision & gauge the distance of objects from the convergence angle of the eyes. It is reasonable to assume that this convergence angle is part of the mechanism that senses and signals the balance between near and far for the regulating the development of the eye.

[163] One of the students with UV and no DVB data [A-6] has since adopted glasses to improve his "lazy eye".

[164] Fig.1 ,p.320, 'Prevalence of refractive errors among different groups of teenagers' Graph:~5% hyperopia for Orthodox males. Hyperopia tends to be stable in college environment.[113] Zero of 20 were found in this Pilot Study.

direct genetic protection – and family free of myopia – represents only about 0.7% of the students.

We have conservatively assumed at §6.2.i.e that 1/3 of A-18 & A-22 is **GENETIC** – like A-13. So the total for No Glasses group with direct genetic influence in our best estimate=1.667×0.714=1.19%. Since we are applying this 1/3rd factor on the basis that 1/3 with very low DVB and no UV were understood to have direct genetic protection, we could further refine this by including the 1/8th of [B-3 + B-19]= 0.25 that are estimated to have No Worsening and the 5% of B-14 that has No Worsening and is estimated to have no UV. This makes the total 3+0.25+0.05=3.30 students with low DVB and no UV and No Worsening, one of whom is understood to have genetic protection: (1/3.30)×2 [for A-18 & A-22]=0.6061; (1+0.6061) × 0.714 =1.147% of students from No Glasses group with genetic protection. The (0.25+0.05)=0.30 students transferred to the no WM group each represents 85/20[169] = 4.25% of all students; 0.30×4.25=1.275%; ×(1/3.30)= 0.386%. Total Best Estimated % of students with direct Genetic Protection: 1.147+0.386=1.53%; Minimum is just A-13 = 0.71%; Maximum is 3.3 students: [3/14 × 10 =2.143%] + [.3/20×85=1.275%] = 3.42%.

Eight of 14 in the No Glasses group - §6.1.a - have **DVB≥45sec/h** and no definite UV. However in the best estimate – §6.2.i.d – we removed 9/20 of one student to allow for possible UV in A-1 & A-2. So 7.55 of 14 are likely protected by DVB>45sec/h. 7.55× 0.714 % =5.391%. To this we add one from the Myopes group, B-23, with DVB≥45sec/h and No Worsening of myopia. With 20 Myopes with suitable data,[169] each represents 4.250% of all the students. So the Total Best Estimated fraction protected by DVB≥45sec/h is 5.39 + 4.25=9.64%; Minimum is 5 non-myopes with No UV and DVB≥45sec/h [(5/14 ×10%) + 4.25]=3.57+4.25=8.1%;[170] unlikely Maximum – where all those with both UV and DVB≥45sec/h are counted as DVB and the "No Worsening" of very high myope, B-21, is assumed to be from DVB[171]: (10/14×10%) + (2×4.25%) = 7.14% + 8.50% = 15.64%.

HOW ARE "BRISK" STUDENTS TODAY PROTECTED FROM WORSENING MYOPIA?
[all data in % of total students]

STUDENT GROUP	TYPE OF ESTIMATE / TYPE OF PROTECTION	# BEST ESTIMATE [165]	# MINI-MUM	# MAXIMUM [166]
NO GLASSES [10% of Total]	DVB [OF WHICH GP]	5.39 [≥0.7]	3.57	7.14
	UV [OF WHICH GP]	2.44 [≥0.7]	0.71	4.29
	GENETIC [INDIRECT GP]	1.15 [≥1.4]	0.71	2.14
	NOT CLEARLY KNOWN	1.02	4.99	[13.57][166]
MYOPES [NEAR SIGHTED] [85% of Total]	DVB	4.25	4.25	8.50
	UV	4.05	4.04	4.05
	GENETIC[167]	0.39	0.00	1.28
TOTAL:* [NO GLASSES & MYOPES]	DVB [OF WHICH GP]	9.64 [≥0.7]	7.82	15.64[166]
	UV [OF WHICH GP]	7.22 [≥0.7]	4.75	8.54
	GENETIC [INDIRECT GP]	1.53 [≥1.4]	0.71	3.42
	ALL THREE	18.39	13.28	27.60[166]
FAR SIGHTED [5% of Total]	[168]	5.00	5.00	5.00
TOTAL:* ALL STUDENTS		23.39	18.28	32.60[166]

THESE % DON'T INCLUDE PROBABILISTIC RANGES ASSOCIATED WITH SMALL SAMPLE SIZE.
* SUBTOTALS MAY NOT ADD TO TOTALS DUE TO ROUNDING.
ABBREVIATIONS: DVB: Distance Viewing Breaks [≥45 sec/h]; GP: Genetic Protection; UV: Unbalanced Vision

For **UV** we have only two that aren't also connected with DVB, A-14 and 95% of B-14. These have a total of 0.71+[.95×4.25=4.04]=4.75% for Minimum with UV protection. More plausible – but conservative as far as the impact of DVB≥45sec/h - is that those with definite UV & DVB≥45sec/h are counted as UV and 9/20[=.45] of possible UV & DVB≥45sec/h is also counted as UV. This yields [172] ([4+.45)/14]×10=3.18) + 4.04 = 7.22%. The Maximum for UV protection assumes all those with possible UV are actually UV – even if the likelihood is low and they also have DVB≥45 sec/h. This is[173] (6/14×10%=4.29)+4.25=8.54%.

7.1.b A fourth set of mechanisms that may have preventive power in some cases – sunlight-outdoor time -- has already been noted in §4.1,¶4. Since it's clear with these students that unless they have sunlamps in their dorms[174] - they're uniformly sunless during the non-vacation periods – questions about outdoor-time were not asked.

However, all 6 of the prior studies of students cited in §1.3 that reported on the effects of eye breaks, also examined the effects of outdoor time. As can be seen in the table [p. 28], in each of the studies where the details were published, the

[165] From best proportional estim, §6.2.i, assumes 3/13 of A-1&A-2 & .95× A-19 are UV +2 whole UV; Assumes A-13+ ~1/3 of A-18 & A-22 are genetic. (5+((10/13)×2)+(.95×1))×(10/14)=5.35>45DVBsec/h best est.- table A. Indirect genetic protection is based on reports of 2 students in §5.3, A-9 & A-24. Much, if not most of UV & DVB may be genetically determined – except for adherence to retzifus ideal- but DVB can be learned.

[166] The sum of maximum values for forms of protection in the "no glasses" group is 13.57% - more than the 10% of the actual students in the "no glasses" group. Some students may be protected by more than one factor or they could reasonably be protected by one of two or more factors and the one actually operating is not known.

[167] This is direct genetic protection from worsening and includes 1/8th of the sum of [B-3 + B-19] and 5% of B-14.

[168] Farsightedness may be a form of protection from myopia – though it requires glasses to see things that are near – like the print in most books. The 39 farsighted students in the Amherst College study showed no change in refraction – as a group – after ~3.8yrs at the college. See footnote 113.

[169] B-1,2,3W?, 5,6,*7*, 9*,*10*,11, *12*,13,14U, *15*,*17*,18, 19W?,21,22, **23**,**24**POL N=20 [* From memory, B-9 is definitely <45 and ≤30 – but exact value was not recorded, and so was excluded from calculations of means of DVB.]

[170] A-**5**,**20**,**23**, **24**,**26**, B-**23**

[171] A-**1**U?,**2**U?,**5**, **12**U,**16**U,**19**U!, **20**,**23**, **24**, **26**, B-21,**23**

[172] A-**1**U?,**12**U,14U,**16**U, B-14U

[173] A-**1**U?,**2**U?,**12**U, 14U, **16**U,**19**U, B-14U

[174] – which I have never seen or heard of and would probably be unacceptable without special medical prescription.

EFFECT OF OUTDOOR TIME ON MYOPIA
[same studies reviewed in §1.3]

REF/ YR/ REGION		SUBJECTS	TYPE OF BREAK	RESULTS	COMMENTS
12-A 2019	CHINA	968 U. Stud. 19.6±.9yrs	performing ≥2 hours of outdoor activity/day	OR=0.45, 95% CI=0.2–0.99	MA, Eye-breaks better
12-B 2018	CHINA	3,753 Child 10 -15 yrs	Outdoor activity time (h/d)	OR=0.74, 95% CI= 0.53–0.92	≥5min break/30-45 stdy min. Eye-breaks better
12-C 2016	CHINA	4,129 Child. Grades 1-4	Outdoor time: hours/day [175]	t= -2.117, P=0.034	MA, Eye-breaks better
12-D 2015	CHINA	1,595 Child. G 7, 12.7y	Outdoor time [176]	Not published	
12-E 2012	TAIWAN	694 Child. Grade 1-6.	Outdoor time. Detailed results not published – except statements that there was no correlation with refractive state [177]		
12-F 2008	AUST-RALIA	2,353 Child. G7, 12.7 y.	Outdoor activity (hours per week)[178]	OR=0.97 (0.94–0.995); P=0.02 [effect is weak & not very significant.]	

ABBREV.: CI: Confidence Interv.; d: day; h: hour; M:Myopia; MA: Multivariate Analysis; OR: Odds Ratio; SE: Spherical Equiv.; VA: Visual Acuity; w:with

benefits of eye breaks were about equal to or stronger than those of outdoor time. In two of the 6 studies, the details on the effects of outdoor time were not published – and presumably weren't significant in the eyes of the author-publishers.

7.2.a Relative Efficiency of DVB. None of these studies noted the relative efficiency of an hour of outdoor time compared with the time for the eye breaks. None of them cite the effects of the short, simulated distance viewing breaks explored by Prof. Wallman, et al, though one of their most cited and comprehensive papers [8-B] referring to some of these experiments is cited by the authors of the 2008 study.

Efficiency and time taken from studying are important. In a typical study day for college students, if there are 5 hours of intensive reading, there would be ~5-10 minutes of DVB to offset it- eliminating myopic progression – including progression from zero. In comparison, >2 hours of outdoor time per day reduced the likelihood of having myopia to 70.7% from 88.5% or 83.9% for those who had, respectively, <1h/day or 1-2h/day, outdoors[12-A]. By these measures, suitable DVB breaks are over an order of magnitude more efficient in use of time[179].

7.2.b Breaks from near-work without breaks from studies. Even the 5-10 minutes a day for DVB need not be taken from studies. One or more projection displays, wall mounted screens or low tech, low cost posters, could supply study related text and images. For younger children, the teacher could switch the students' attention to the screens or posters.

For older students with independent reading and only a minute or so required per student, a single display could supply the needs of 20 or more students. Each student could be allotted a particular time slot and/or sector of the display for their breaks. The system could automatically shift the image from a desktop or handheld screen to a distant wall image. Similar systems could be developed for libraries, homes and even some work places.

7.2.c The question of the apparent conflict between breaks and study turns out to be a key to the success of this Pilot Study. If the Yeshiva students were not very conscious of the ideal of retzifus learning – of learning without any breaks[56] – they would, like most people, probably not be very conscious of the breaks that they actually took—particularly when we're talking about breaks of 2 or 3 minutes per hour or less. For the same reason, they remember these breaks with a level of detail and accuracy that would not be expected from ordinary college-age students.

This same concern with breaks would make it easier for these students to keep track of their breaks going forward. If a state of the art scientific study protocol required them to take breaks with a certain pattern – for example one minute per hour – they'd be able to keep track of these breaks without having to interrupt their studies to take note of each break.

7.3.a Students' Integrity: Combined with their high level of integrity and concern for the future impact of myopia on health, they could be relied on to follow a prescribed DVB protocol and report accurately – day by day -- what they actually did.

This same integrity makes the responses these students gave me that much more reliable. They were not afraid to tell me what they were actually doing. They were not aiming to please me by telling me something that I wanted to hear. They love truth and are accustomed to argue – with a rare combination of knowledge, acumen and respect – over what they believe to be true. They understood -- from the informality and sincerity of my approach and lack of official connection -- that truth is what I actually wanted.

The students' love of truth was a major factor offsetting a key potential weakness of this work: I conducted all interviews myself. The weakness is a possible lack of sufficient detachment: perhaps a tendency to not press eyeglass wearers as much as non-eyeglass wearers to reveal their eye-break time. This a

[175] This is the effect of each extra hour of outdoor activity per day. From Table 5, p12 of 17, directly comparable to -2.280 0.023 for eye beaks, already discussed in §1.3, supra & shown in the associated TABLE.

[176] Though this study collected detailed data on outdoor activities, including hours spent, it did not publish any data on how this activity correlated with myopia but concentrated on the effects of various nearwork activities.

[177] "These visual parameters were also associated with mother's (but not father's) refractive error, ingestion of table grapes, near work, and indoor exercises, but not [associated] with outdoor activities on weekdays, weekends, or during vacation time." "There was, however, no correlation between visual acuity/spherical equivalent and (i) weekday after-school static or physical activities; (ii) duration of TV watching at all times; (iii) duration of outdoor activities at all times;"

[178] "General outdoor activities, leisure activities, and outdoor sports."

[179] If outdoor activity is walking to/from school , it may not cost "full time".

version of the "Clever Hans"[180] effect – where we can convince ourselves of the rightness of an idea and unintentionally influence those we're "studying" to give a desired response.

It's my impression that though there may be some Clever Hans issues with the survey methodology, these students were generally forthcoming with their best, most accurate answers and understood the seriousness of the study and the interest of the author in getting accurate responses.

Doing all of the interviews myself was also a major source of strength. The strength came from the ability to understand in detail the nuances of many of the responses that might have been lost with a more formal, preconceived and detached survey technique.

Still, a better methodology might involve a more standardized interview process with interviews conducted by people who didn't have a psychological stake in a particular result. This would probably only be possible if the study had the direct approval of the Rosh Yeshiva and the students were confident that their personal details would not become public if they wanted them to remain private.

Some students may only wish to cooperate fully if they're sure that even the Rosh Yeshiva –and their parents – wouldn't know. This would distort the results of those cooperating in the direction of students with minimal breaks. Perhaps this is why those experts who were aware of the real situation didn't try to make a formal study of DVB of these students.

7.3.b Question the students carefully. It should be clear if the student is taking a break to look at his phone or wrist watch [#B-14 & B-18] or to look around without focusing on anything at a distance [B-22] or to actually focus on something distant – like the wall clock, Aron Kodesh and the Rosh Yeshiva's seat. Students who say they take no breaks should be questioned on specific types of breaks – to look at the clock, Aron Kodesh, etc.

It's also possible that a student takes a type of DVB – but without appearing to lift up his eyes from the page. Student A-17 defocused his eyes and "looked through" the page. However, such a defocus is not the same as a focus on a distant object in terms of the actual retinal stimulus. Also, some part of student's eye-break may be real DVB while another part of the same break may not be DVB at all – as with student B-22. His understanding was that 90-95% of his "break time" was not DVB but just "looking around" without focusing or looking at anything – while thinking about what he had just read.

7.4 The value of surprises. My impression, based in part on the number of surprises, is that I faithfully recorded what I actually observed and that the students told me what they understood to be true. Among the surprises were:

A. Of 19 students[181] in Group A who did not wear or need glasses or contacts, 5 reported having Unbalanced Vision and 2 of the 19 were definitely not asked. I was so unprepared for this as a significant factor, that for the first three who volunteered this, I failed to question them at all about breaks. All those with glasses were questioned about UV and all said they didn't have it. But student B-14's prescription revealed that he very likely didn't see stereo. He also had the lowest level of myopia in Group B [Avg. for both eyes -0.5D] and was one of only three in Group B with zero year to year change in his prescription.[182];

B. Those with very short breaks at frequent intervals—something I never heard before, had never imagined & is a combination that produced no protection from myopia in the studies with chicks.

C. A-13, who seemingly did almost everything conducive to myopia[183] -and had none- had eyes that apparently worked together – and when asked – had both parents and all siblings that did not need or wear glasses - but cousins who did. I interviewed him while we both walked quickly a few hundred meters – as he was rushing to catch a plane[184].

D. B-24 – taking 360sec DVB/h with worsening myopia – though at a very low rate and with a possibly strong genetic tendency to high myopia.

E. Apparent gaps in the data**?** In the main analysis – using the single probability weighted values of the 5 ambiguous responses, there were no students with average breaks in the range >30<60 sec/h. One would ordinarily expect that if DVB of 60 sec/h is highly effective in stopping the progression of myopia -- or preventing its onset in the first place -- that values of 20 to 40sec/h would have a noticeable effect. There is at least one possible case of an effect with a lower "dose": B-21, where breaks of 18-40 seconds per hour were associated with stopping the worsening of very high myopia.

[180] The "Clever Hans Effect" is where an experimenter subconsciously influences responses of those – people or animals-- being studied by a combination of subtle cues of body language, voice tone or failure to question with the same energy when the answer goes in an "unwanted" direction. Clever Hans was a horse whose trainer thought he'd taught him to do arithmetic. The horse couldn't --but was very clever in reading the trainer's subconscious body language. Oskar Pfungst 1911.

[181] Includes A-3 & 4 -- who were in a rush & not asked about DVB -- & excludes A-6, who I saw wearing glasses regularly for "lazy eye" – (tho' when interviewed, he was not wearing them) -- he has +2.5 & -1.5.

[182] The other 2 students with no change in prescript'n were B-21 & B-23.

[183] I did not ask him how close his eyes were to the page he was reading or if he read in the dark and avoided orange and yellow vegetables. See § 5.8 Information on Eye-Health

[184] From the distance & speed I estimate it was ~4 min. From this I estimate the avg. of all interview was ~3-7 minutes; 5-7 min. for eyeglass wearers.

The range of break lengths just noted here for this student – as opposed to the single number used in the basic initial analysis- suggests a whole group of 'hidden students' whose break data falls into this and other apparent gaps. For example, where A-1 said his breaks were 20-30sec. every 20-30 min, 60sec/h was used as the most likely value. It actually means a probability distribution from 40-90sec/h with the greatest weight in the center. The same range applies to students A-2 and A-5. The upper bounds of these three also help fill the lower end of the 60 to 180 sec. gap, while the lower ends of the ranges of A-12, A-16 and A-26 help fill the higher end of that gap.

F. Relative Rarity of Partial Effects: This may be due to the narrow threshold for activation shown graphically in the paper of Wallman and Winawer, 2004.[185]

If the ordinary use of the eyes of chicks -- or the eyes of the students' shepherd-farmer ancestors – primarily involved near work with short, intermittent periods of distance vision, the eye growth mechanism would be optimized for this behavior.

Rather than starting and stopping the growth process every time the focus changed between near and far, growth may be designed to occur in relatively long, steady and more efficient episodes. These episodes would be controlled by an accumulated signal made up from the usually short periods of distance viewing in a given longer period of time. Once this signal passed a threshold, the growth would stop for a specific length of time – unless there was a stronger than usual accumulated signal from near work that stimulated growth.

The eyes of students grow very slowly: at the highest rate of growth, they're lengthening ~1µ/day, 1% of the rate of hatchling chicks.[186] It could be that all of the growth takes place in one efficient, uninterrupted episode per day – maybe while we're sleeping[187]. This would mean the growth signals would have to accumulate – perhaps in more than one stage- over the course of a day's activity. The system may be designed to ignore signals that are too short – like 1 second or less – or that amount to less than 30-50 sec/h in a one to two hour time frame.

Behavior that is too far different from this- like studying without enough DVB - will produce myopia from the failure of the "stop growth" signal. In the case of student A-13, a different mechanism may be involved – where a single, short, distance viewing episode with coordinated parallel orientation of the two eyes – provides the growth target.

G. The graph [page 38] shows rate of change of myopia vs DVBsec/h, for 24 students with and without glasses, who had such data. Those others

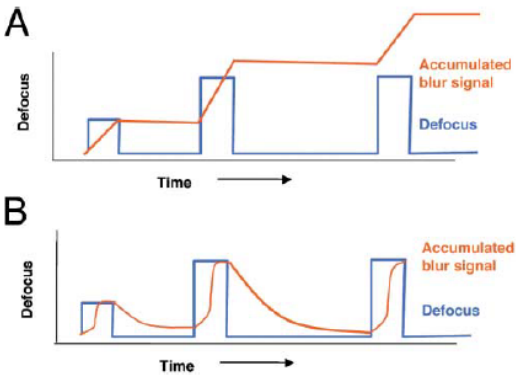


Figure 6. Temporal Integration of Defocus

In a simple linear model of emmetropization (A), the amount of defocus signal accumulated depends only on the total amount of defocus experienced and not on its temporal distribution. In a model more faithful to the data from chicks (B), there is a delay before the signal builds, a saturation after a time, and a decay in the absence of defocus. Thus, the accumulated signal will depend on the frequency and duration of periods of defocus, as well as on the total amount of defocus. The accumulated defocus signal could be neural, biochemical, or a combination of the two.

with UV, known MF, outlier B-24 and 'very likely genetic' A-18 are also shown.[188] Linear regression of the 13 myopes with non-zero change in prescription $Y=0.1682X+0.677$ with almost no correlation: r=-0.0545; p= 0.86.[189-A] The data for all 24 are well fit: r=-0.7449, by an exponential function.[189-B] However, the data are biphasic –with a trigger to a 'zero change in myopia phase' starting between ~30 & 45sec DVB/h. Those with 'zero change' may actually have small positive or negative changes below their awareness threshold.

It appears from the scatter of the points below the 45 sec DVB/h line, that such sub-threshold DVB normally[190] has no noticeable effect on the worsening of myopia. There is also a large open space above the 45 sec DVB/h threshold and to the right of the B-24 outlier. We also see that DVB substantially above threshold doesn't tend to make one far-sighted.

8.0 FURTHER WORK

This Pilot Study is primarily intended to determine if there is reasonable cause to conduct a state-of- the-art investigation of the effects of suitable amounts of DVB on the worsening of myopia in college-age men. Such a study would involve the precise measurement of the eyes of a selected group of 60 or fewer students whose myopia has been getting worse at a

[185] Red text & lines: ASA. Original: p. 451.

[186] Highest rate, normal growth: ~1D/y;Δ~1µ/day eye length. Hatchling chick eyes ~100µ/day—in 3-day studies of J.Winawer & J.Wallman, 2002 [see Table on p.34, infra]

[187] A. Maybe growth takes place after periods of stasis of several days or more. Baby length increased in spurts ~1cm /day during a single day with periods of stasis of ~12 days. M. Lampl, J.D. Veldhuis, M.L. Johnson. 1992 B. A.R.Harper & J.A.Summers 2015 C. S.Backhouse & A.Gentle, 2018.

[188] UV: Unbalanced Vision; MF: Myopia Free Family [only A-13 whose data is same as A-18. B-24: outlier among eyeglass wearers, A-18's father: extreme myopia [-13D]; See table B for details.

[189] A. Calc.[p.38]13 with non-0 prescr. change, excl. UV, MF & outlier B-24 http://www.statskingdom.com/400simple_linear_regression.html B."Exponential growth function" from http://www.xuru.org/rt/NLR.asp#CopyPaste *'Online Nonlinear Regression'*:used 3rd best fit: $y=0.9084*(e^{(-37.348*x)+1})$, $R^2=0.555$, $R=0.745$; 2nd best: $y=0.239/(x+0.120)$, $R^2=0.604$; hyperbola, neg. time for neg. growth & large drop: y=.8, x=.18; y=.28, x=.72; best: $y=1.987*(x^{(4.22*x)})$, undefined for neg. growth & non-monotonic x=.18,y=.54;x=.36,y=.42; x=.72, y=.73; $R^2=0.627$. +A18, N=25 $y=0.8486*(e^{(-32.988*x)+1})$, $R^2=0.431$, R=0.657 this is also 3rd best fit, same reasons. Xuru's website, running ≥7yrs, & email, thru which I thanked him, aren't working: 12/21/'20- 6/01/'21. A health query was sent to Brendan McKay, ANU. Rates of change of myopia for students B1,B13 & B15 were re-estim. from new data on 1st prescriptions & incl. in 24 student data set below, but regressions not re-run see footnotes 103.d & 109 & p. 38. Graph points computed at https://www.meta-calculator.com.
1.778,1.778,1.778, 1.778,2.255,1.301, 2.556,2.301,2.512
0, 0, 0, 0, 0, 0, 0, 0, 0
0, 0, 0, 0, 1.477,1.176, 0.301,1.176,0.301, 0.778,1.477, 0, 1.462,1.176,2.477
0.17, 0.25, 0.50, 0.76, 0.76, 0.33, 0.50, 0.09, 0.14, 0.40, 0.25, 0.76, 0, 0.67, 0

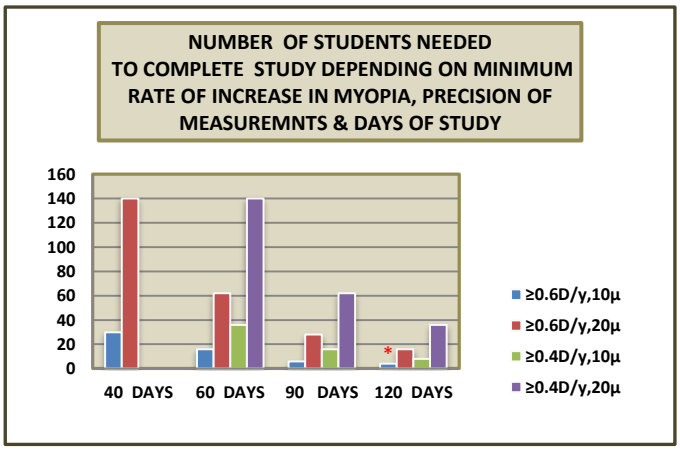
[190] Subthreshold DVB may have affected very high myope, B-19.

rate ≥0.4D per year. This rate could be based on an examination of recent prescriptions for glasses, supplied by students.

The current state of each student's eyes – particularly axial length - would be measured by highly competent and experienced staff using the best available non-invasive equipment, techniques and protocols.[191] This combination should be capable of reliably measuring students' eyes --- particularly axial length – with a precision of ±10μ or better[196]. As can be seen from the chart at right, the level of precision - in the range of ±10μ to ±20μ - strongly effects the combination of number of students and time necessary to achieve a reliable result.

Time to completion is more important here than usual: Fricke, et al[5], indicate that, globally, in the coming decade – between 2021 and 2031- there will be 15k to 60k people going blind from MMD per month [95% CI] [192]. In the Jewish community, this might come to several people per week.[193]

The chart shows a total of between 5 and 140 students would be needed depending on the rate of worsening of the students' myopia, measurement precision and the length of the study.[194] In all



cases, it's assumed the students would be divided into two equal groups. Each group would be required to adhere to a different program of DVB. One program would be expected to be fully effective: ~90 seconds of DVB per hour of intensive study every day. The other group would be expected to be half as effective – doing the same thing – but only on half of the days or every day but for half of the hours per day.

The students would record the hours that they actually observed the protocol by checking off the particular hours on personalized forms. They wouldn't have to do this check-off during study time -- but could do it at lunch and dinner breaks- from memory[195]. The study design should allow for a certain fraction of the hours and days to be missed -- where, for whatever reason, a student wasn't able to follow their assigned DVB protocol.

After 40 to 120 days - depending on what the experts feel would be the shortest time for a reliable result with the available resources- the students' eyes should be measured again. These measurements should be made by staff 'blind' to which protocol was assigned to any given student or what a student's previous measurement was. They should also be made at about the same time of day, the same pre-measurement student diet

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[191] A. An example of the type of equipment & precision possible in measuring the eyes of college-age students is in: D. Moderiano, Ranjay Chakraborty, 2019. They reliably measured changes in axial length & choroidal thickness in young adults using 2 groups of 12 & 13 subjects each. Standard deviations of ±5μ were achieved. They found differences in the effect of different types of lens wear (such as 1-2 h) of monocular defocus) on the growth of human eyes depending on the time of day the lens is applied. Results could be reliably obtained in <3 days. They used IOLMaster500, Carl Zeiss, Jena, for axial length & an optical coherence tomographer Cirrus HD-OCT 5000, Carl Zeiss Meditec Inc. Dublin, CA, USA, for subfoveal choroidal thickness.

B. A study using only 7 subjects & 1hr of reading time in each of 2 experimental conditions: 14 experimental person hrs "... found that the choroid, the heavily perfused layer behind the retina in the eye, becomes about 16μ thinner in only 1hr when subjects read black text on white background but ~10μ thicker when they read white text from black background."A.C.Aleman, M.Wang & Frank Schaeffel (2018)

C. Zeiss IOLMaster700 has 5μ S.D. of repeatability on axial length with no eye contact. P11, manual, Carl Zeiss Meditec,2015.

[192] Computed from a graph [Fig 3B, Fricke et al, 2018] which shows number of people in the world expected to have MMD blindness, by decade, 2000-2050. This forecast is intended to show what will happen if a good method of curtailing or preventing myopia isn't found soon.

[193] The expected percentage of those affected who will be from the Jewish community is lower in the near future – the next ten years – than in the more distant future – 2050. This is because the relative population of those Jews most likely to be affected by this – those with the highest rates of myopia – is much smaller today than, based on current trends, it is expected to be in the next 30 years.

[194] The number of students was calculated using a free, on line, "sample size calculator:" https://clincalc.com/stats/samplesize.aspx. The assumptions used were:

a. Two equal size groups will each receive different treatments.
b. Primary endpoint is continuous [not dichotomous] & average changes in lengths of the 2 groups will be compared.
c. A rate of 0.5D/y increasing myopia is associated with ~1μ increase in eye length in 2 days. [See footnote 69 & fig. on p. 15 – where 400μ increase in vitreous chamber depth = 1.0D increase in myopia. Chart isn't precisely drawn & is somewhat crooked.]
d. The group with full treatment – receiving ~90sec DVB/h during study periods/day- is expected to show: Groups with: A. ≥0.4D/y worsening [avg 0.5D/y[see §5.6] 30μ; B. ≥0.6D/y worsening [avg. 0.75D/y] 45μ-- A&B: mean reduction lengthening compared with prev. rate– in 60 days treatment; & proportional for 40 & 90 days.
e. Anticipated standard deviation [sd] of 30 or 45μ mean, is ±10μ or ±20 depending on sensitivity of measurement technique.
f. Group with 1/2 treatment [either every other day or every other hour—[not ~45sec DVB/h] should have 1/2 change in same time.
g. Study shows false positive 0.5% of time: There's a 0.5% chance study will show DVB treatment is effective when, in fact, it is not.
h. There's a 95% probability experiment will show DVB is effective if, in fact, it is. This is the highest value available on this calcultr.

[195] A. Glasses mounted devices could detect head movement & record students reading linked text from image displayed on distant wall. With only 4 students needed in a 120 day study, this could corroborate a short study based the integrity of student reports. Multiple measures at more frequent intervals, e.g. 2, 3, 4 & 5 weeks, with trend line analysis, could produce reliable results with fewer students in a shorter time than the two point, standard analysis shown above. Care should be taken to keep measuring staff blind to test group & distinguish changes in short term choroid thickness & long term scleral length.

B. Frank Schaeffel,2019[see also footnote 191-B] cites 1. Yingpin Cao, et al, 2020, 2. AKESO 3. Vivior Monitor

and other relevant activities and in an 'office' with constant temperature, humidity and lighting[196].

It may be possible to use a specially equipped "test van" parked at the Yeshiva where that hour's students will be measured. Actual measurements take only a few minutes per student, but it's desirable for them to spend a standard amount of time in the 'test van' to get acclimatized – perhaps 15-20 minutes -- before measurements are made. So, the van should accommodate several comfortably seated students. For adults, swept source optical measurement instruments – such as the IOLMaster 700[197] - don't require eye-drops for precise measurements[198]. Students can watch a video or study up to and immediately after measurement.

Based on this pilot study, it's expected that the 90sec/hour protocol during periods of intensive study will cut the rate of most of the students tested to close to zero. This should apply for students who do not have one or more parents with very high myopia – like student B-24. Even such students should benefit from DVB – though the dose may have to be substantially higher than one minute per hour. Some with such family background - like student A-18 -- who had zero DVB/h, no apparent myopia and a father with -13D myopia - appear to demonstrate that the "high myopia genes" may not be sex linked or dominant.

Because of the global dimensions of the myopia issue, it would be desirable for the study to be done in collaboration with leading experts from diverse parts of the world –particularly where the problem is most acute. This would shorten the time to broad implementation if the study proves the value of DVB in curtailing myopia.

Thus far this study has focused on curtailing myopia by stopping inappropriate elongation of the eye. It may be possible to induce the remodeling of the eye – so an overly long eye may be made to shrink in a controlled way. This would be analogous to the active remodeling of bone that takes place with the aid of osteoclasts and the observed remodeling of cartilage in scar tissue by "fibroclasts" and "myofibroclasts".[199-A]

9.0 CONFLICTS OF INTEREST?

At section "4.7 CONFIDENTIALITY & ETHICAL ISSUES", supra, this report includes statements corresponding to the usual: This study was approved by the Human Ethics Committee of University X and was carried out according to the tenets of the Declaration of Helsinki"[48].

But there's another type of conflict of interest that hasn't been discussed. While I've noted that I became aware of the work on the etiology of myopia in pursuit of the source of the advice I received from my grandmother in 1955,[31] I didn't say what led me to appreciate the size of the problem.

I was working on a market study for a virtual image, biocular reading device – the Personal Reader™.[30] Since the device has the clear potential to reduce the load of near work by shifting the virtual image to a distance some meters - or more - from the eye,[123-B,C] I looked into the global size of the myopia problem – now and in the future. From this data I estimated ~1/5th of the market for this device might be closely related to myopia control.[199-B] As I continued to monitor forecasts of the myopia problem, I saw the remarkable study of T.R. Fricke, et al,[5] forecasting a global plague of myopic macular degeneration and associated blindness, visual impairment and other major ocular diseases.

Since I'm Jewish and the Personal Reader has special advantages for religious Jews – it can be used on the Sabbath to read books on microfiche – I looked at how this myopia plague would be expected to impact the Jewish community. It appeared from the paper of D. Bez, et al.[17] – published just 45 days before I began these interviews– that, the religious Jewish community might sustain among the highest per capita adverse impacts from myopia. In particular, they reported High Myopia among Chareidi young men in Jerusalem is apparently at the highest published rate for a sizable demographic group in the world.[200]

So I focused on them and saw that the Chareidi Yeshiva Program was a natural "found" experiment on the possible effects of DVB. I thought some of the students might be practicing it -- having learned it from their rabbinical families, as I had learned it from my grandmother, in 1955.

If I hadn't had this mistaken preconception – that a substantial fraction of those without a need for glasses might be practicing something they learned from their families – I probably would not have undertaken this study. With this preconception, I didn't need to imagine that such a behavior could be untaught, unlearned and spontaneous. I also didn't need to think of the difficulty students might have remembering the details of breaks they were not consciously aiming to take.

Were it not for the retzifus ideal[56] – or the broader general ideal of not wasting time -- in the back-

[196] "Choroidal thickness peaked at 2.42 hours, with a diurnal variation of 25.8±13.44µm. Axial length peaked at 12.96 hours, with a variation of 35.71 ± 6.6µm." n=42, adults 22-41y, H.J.Burfield, A.Carkeet,Lisa A.Ostrin, 2019

[197] ~$12K & may be leasable; probably available in offices of cataract surgeons in major cities; there are probably close competitors. For ophthalmologists doing Intra-Ocular Lens[IOL] implants- where very small errors in measurement can effect on patient's vision. Gregor F. Schmid,. 2019

[198] Sehnaz Ozcaliskan, Nursal Melda Yenerel 2019

[199] A. P.S.Baur,Jr, et al. 1979. See footnote 6.B
B. see p 47, Personal Reader: Intuitive Market Study §8.1 & 8.2.

[200] They didn't note that it was the highest published rate. This was my observation – as I hadn't seen any higher numbers.

ground of these students' learning program, it would probably have been a lot more difficult to get useable data. Since I imagined that the students taking breaks were taking them deliberately, I did not even think of the retzifus or time-value ideals before I set out.

The success of this study in collecting DVB data from the students rests largely on their consciousness of this ideal and their remarkable capacity to remember the details not only of what they study but of how they go about it – to make the most of their time. It also rests on their integrity and concern for others.

10.0 ABOUT THE AUTHOR

I am an autodidact from age two[201-A] and not primarily a product of an academic, institutional education. I did not attend college as a formal student for even a single day and have no degrees or diplomas.

The last time that I cooperated with a conventional educational program was as an entering sophomore at the Bronx HS of Science, when I was 14-15 years old. At that time –the 1966-7 school year- Bronx Science was considered the best public academic HS in the US. It still holds the world record for the highest number of former students who later received a Nobel Prize in science: eight. There are 2 runners up for HS with the most science Nobelists, both of them with only 5. [201-B] This "best school" rating wasn't a product of the school's pedagogical methodology. It was the result of a competitive admissions test and a pool of very bright NYC students.

With the war in Vietnam at its height, I resisted the draft. Any clever person could get out of it-- but I thought that not only was the war a crime, the draft was its criminal partner. I expected to spend what for most others would be their college years – 18-22 – in a US Federal Jail—studying Mathematics, Biblical Hebrew and Classical Chinese. But that's not what happened.

Instead, [as related on page 42], I began to study Public Transportation Policy and made some important discoveries in this field. After several years, I became an informal, personal student of Prof. William S. Vickrey – who went on, two decades later, to win a Nobel Prize in Economics. [202-A]

Extensive use of technical reports on microfiche in my transit policy study- and knowledge of samizdat in the USSR[-202-B] led to my search for a "censorship resistant" system for sustained reading of both fiche and future micro-miniature optoelectronic displays.

As already noted[30], while preparing a current market study for this new reading system -- I call it the Personal Reader[203]-- I saw the looming myopia plague. Then, on the basis of what grandmother had taught me when I was 3 years old – "Every 15 minutes, pick up your eyes from the page and look out the window – it's good for your eyes" I stopped work on the Personal Reader and other ongoing projects[204] and, produced this study.[205]

My experience developing important results and insights in diverse fields: transit policy, visual optics, world affairs and Torah Studies, gave me the confidence to initiate and carry out the present work.

[201-A] I remember not being interested in food unless my mother read to me. While she read, I asked her to point out several words per page and tried to drink in the words with my eyes. By 3, I could read on my own and began to study arithmetic from the checkerboard pattern on the kitchen floor. The only thing that I definitely learned in school was cursive writing – which was destroyed by almost daily punishment assignments in 6th grade.

[201-B] There is only one other HS in the world with 8 Nobelists: Lycée Louis-le-Grand, Paris, France. However only 4 are in science (counting economics as science) and only one of the 8 (in Physics) is during the existence of Bronxx Science. Of the 2 runners up, James Madison HS of NYC has 5 during the period that Bx Science existed and Phillps Andover has 5 – but three of them are from before Bronx Science was founded.

[202-A] Dr. Robert N. Rickles, former NYC Air Resources Commissioner [1970-71] put out a 5 page press release: "Private Public Transit"-[1977] mostly 2nding my call for an open market for bus service. Until then, he'd been a leading U.S. advocate of transit subsidies. In that 5 p. work he emphasized my ideas & referred to me as a student of Prof. Vickrey – which I'd never claimed to be. When I went to apologize to Prof. Vickrey – with whom I already had several substantive academic & personal conversations over a period of a year, he said "Don't worry. You're my student." My study also favored special assessment funding of free subways – analogous to the way elevators are paid for - & high-tech & low-tech systems of road user charges.

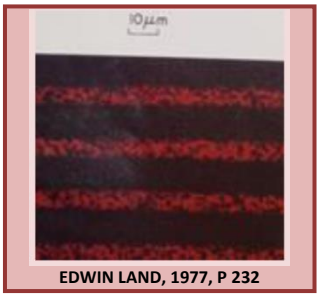
B. I read of the Oct. '72 trial of Soviet astrophysicist, Kronid Lybarksy , who had disseminated controversial books on microfilm. [p 17, "A Chronicle of Current Events, #28-31" Amnesty International, London, 5,'75]

[203] A. I was initially told by George Margolin, a NYC based expert on personal microfiche readers, that this was an old idea – but it wouldn't work. Such systems, he explained, require a large exit pupil- about 10× the diameter of what's found in conventional microscopes. This meant that– with the Abbe sin condition & Lagrange invariant- at higher magnifications the system would be impossible & at somewhat lower power it would be prohibitively expensive. The rule of thumb in optics is, *ceteris paribus*, cost varies as the square of the exit pupil diameter. [see, e.g., Paul L. Ruben, (1966)

B. I looked more carefully at the problem and saw that, while he was right about the Abbe & Lagrange laws, in comparison with regular microscopes, *ceteris paribus* didn't apply. I sought & received an evaluation from an expert in optics, David Grey, who was considered second to none in the world. He was a founding father of computer aided optical design & had been Edwin Land's right-hand man in this field. He said I'd solved a problem that had been on the optical design community's agenda for decades & it could be mass produced inexpensively in plastic.[see p. 44 for 1 page of his 8 p. report.]

With this, I received Edwin Land's recommendation on the microfiche only version in '83. He thought it would go with a 'pocket copy' instant microfilm camera. Prof. Land, who'd retired from the company he'd founded but still owned the largest block of stock, warned me: "Good ideas are rejected for good reasons & for bad – mostly for bad. Don't get your hopes up." C. Polaroid believed they could make & sell a billion dollars' worth of Personal Readers.

D. It was rejected by Sr.V.P., Sheldon Buckler, claiming the instant microfilm they'd developed [Polavision's monochrome base] didn't have the needed resolution. He said, without the film, it didn't fit Polaroid's product line.[see p 44] [The film was actually good- as shown in Edwin Land's report [right] & a production sample that I studied– but the last resolution test was made during a production transition. When Polavision died 2 years later, no new tests were made.]



EDWIN LAND, 1977, P 232

[204] Including several Torah related books: 1."Torah and the Taliban": a quantitative study of the pre 9/11 Taliban. It shows that nearly all of the accusations made against them are false. It was publicly praised by world renowned Afghanistan expert, Prof. Barnett Rubin & was a significant factor in Pres. Trump's start of face-to-face talks with them. [See p 45] 2. Novel interpretations of the Torah – incl. an analysis of the Biblical Flood according to both Jewish Tradition and "natural law". [see p 45] 3. "Applying Torah In Public Life" including an update of the transit policy study. [See p. 43 & 44]

[205] See Dedication on Last page

Table 2
Results for all experiments for lens-wearing and fellow eyes

Daily lens-wear	Refractive error (D)		Ocular length (μm)		Vitreous depth (μm)		Choroid thickness (μm)	
	Treated	Fellow	Treated	Fellow	Treated	Fellow	Treated	Fellow
Continuous								
14 h, 1 × (+7 D)	5.6 ± 0.8	−1.3 ± 0.9	−13 ± 44	143 ± 42	−159 ± 48	51 ± 34	107 ± 25	−5 ± 24
14 h, 1 × (−6 D)	−3.3 ± 0.7	0.3 ± 0.6	290 ± 53	179 ± 27	273 ± 24	58 ± 27	−75 ± 35	−7 ± 21
Experiment 2								
2 min, 14 × (+6 D)	3.8 ± 1.1	0.4 ± 0.2	90 ± 12	208 ± 21	4 ± 16	175 ± 15	−7 ± 18	−92 ± 15
2 min, 14 × (−6 D)	−3.8 ± 0.9	−1.0 ± 0.3	312 ± 16	211 ± 20	278 ± 14	184 ± 18	−99 ± 16	−82 ± 15
7 min, 4 × (+6 D)	NM	NM	63 ± 22	232 ± 29	−10 ± 23	179 ± 22	−14 ± 16	−39 ± 13
7 min, 4 × (−6 D)	NM	NM	206 ± 23	191 ± 19	225 ± 20	193 ± 18	−106 ± 20	−90 ± 19
Experiment 3								
2 min, 14 × (+6.7 D)	2.4 ± 0.7	−1.5 ± 0.5	82 ± 21	301 ± 26	−11 ± 25	219 ± 19	−13 ± 19	−33 ± 14
28 min, 1 × (+6.7 D)	1.2 ± 0.5	−0.9 ± 0.4	137 ± 17	276 ± 21	49 ± 22	199 ± 16	−18 ± 13	−37 ± 9
Experiment 4								
2 min, 7 × (+6 D)	4.0 ± 0.7	0.3 ± 0.4	115 ± 52	281 ± 36	10 ± 41	202 ± 16	−27 ± 8	−18 ± 17
2 min, 7 × (−6 D)	−3.8 ± 0.3	0.3 ± 0.7	389 ± 24	294 ± 32	280 ± 29	178 ± 33	−34 ± 14	1 ± 12
20 s, 42 × (+6 D)	0.2 ± 0.8	0.1 ± 0.6	71 ± 46	136 ± 22	7 ± 44	106 ± 22	−50 ± 21	−86 ± 31
5 s, 168 × (+6 D)	1.0 ± 0.8	0 ± 0.4	41 ± 23	82 ± 12	42 ± 30	125 ± 29	−101 ± 19	−150 ± 20
5 s, 168 × (−6 D)	−2.5 ± 0.6	−0.8 ± 0.5	112 ± 34	99 ± 39	191 ± 30	155 ± 29	−175 ± 23	−142 ± 24
2 s, 420 × (+6 D)	−0.9 ± 1.2	−0.8 ± 0.6	224 ± 43	214 ± 18	118 ± 22	100 ± 18	−43 ± 15	−21 ± 20
2 s, 420 × (−6 D)	−2.7 ± 1.1	−1.1 ± 1	217 ± 26	168 ± 42	244 ± 21	134 ± 18	−158 ± 33	−92 ± 48

SOME OF THE DETAILED RESULTS OF INTERMITENT DISTANCE VIEWING EXPERIMENTS WITH HATCHLING CHICKS, SHOWING SIGNIFICANT RESULTS FOR 2 MINUTES IN 2 HOURS BUT VERY MIXED RESULTS FOR 20 SECONDS IN 20 MINUTES AND 2 SECONDS IN 2 MINUTES. J. WINEWAR & J. WALLMAN, 2002, VISION RESEARCH, VOL. 42 P. 2656

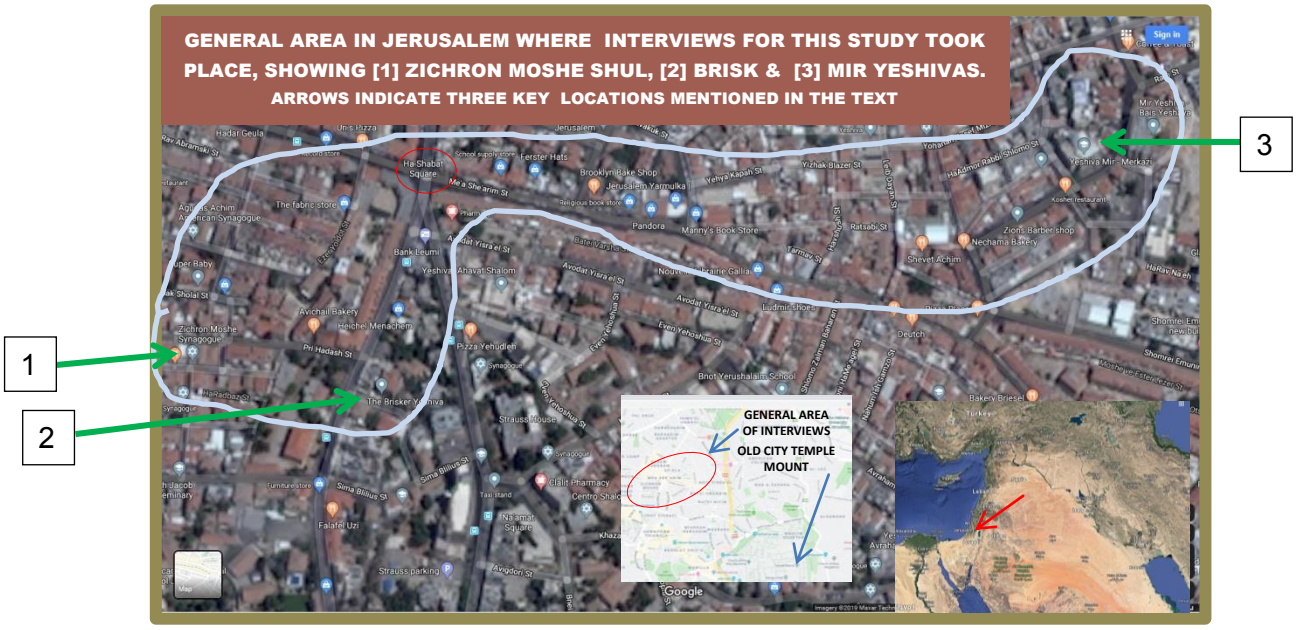

GENERAL AREA IN JERUSALEM WHERE INTERVIEWS FOR THIS STUDY TOOK PLACE, SHOWING [1] ZICHRON MOSHE SHUL, [2] BRISK & [3] MIR YESHIVAS.
ARROWS INDICATE THREE KEY LOCATIONS MENTIONED IN THE TEXT
1
2
3
GENERAL AREA OF INTERVIEWS
OLD CITY TEMPLE MOUNT

TABLE A DATA FROM INTERVIEWS WITH "BRISK" STUDENTS WHO WERE NOT WEARING GLASSES

7/13-28/'19 [+1, 8/23/19] +3, 8/31/19, 9/06,7,13,14/19, 10/29/19 A. S. ADLER , JERUSALEM avshadler@yahoo.com

INTER-VIEW # [206]	INTERMITTENT DISTANCE VIEWING BREAKS: LENGTH EA. BREAK, SEC. LOG[10]	START OF 1 BREAK TO START OF NEXT, MIN.	TOTAL BREAK TIME [207. A] SEC/H	LOG[10]	PLANNED/ SPONTEOUS	COMMENTS	UNBALANCED VISION: UV			APPEARANCE[220]: AGE	HT	BUILD	HAIR	FAMILY INFO[221]	
1 B-UV?	20-30, *1.40*	20-30	60	1.778	S	LOOKING AT ARON KODESH & AROUND BES MIDRASH	NO? [222]			E 20's					
2 B-UV?	2-3 *0.40*	2-3[208]	60	1.778	S	[209]	NO? [209]								223
3 R	THESE 2 STUDENTS SAID THEY DIDN'T USE OR NEED GLASSES OR CONTACTS & DIDN'T HAVE						SURGERY -- BUT I COULDN'T COMPLETE INTERVIEW AS			NOT COUNTED					
4 R	THEY WERE IN A RUSH. INTERVIEWED IN SAME TIME FRAME & PLACE AS #1 & 2 NEAR						ZICHRON MOSHE SHUL, AFTER SHABBES.			NOT COUNTED					
5 B	2-3 *0.40*	2-3	60	1.778	S	"LOOKS AROUND THE ROOM" WHENEVER HE IS LEARNING	NO[224]			E 20's				[225]	
6 UV						DIDN'T ASK ABOUT BREAKS AFTER HE SAID HE HAS "LAZY EYE"	'LAZY EYE'	DOESN'T USE OR NEED GLASSES [226]		E 20's					
7 M						NOT WEARING GLASSES OR CONT-ACTS BUT MYOPIC NOT COUNTED				E 20's					
8 UV						DIDN'T ASK ABOUT BREAKS AFTER HE SAID HE HAS UV[210]	1 FOR DIST. 1 NEAR	SWITCHES AUTOMATICALLY BETW. EYES, NO HEADACHES		E 20's					
9 UV						DIDN'T ASK ABOUT BREAKS AFTER HE SAID HE HAS UV	ONE EYE GOOD FOR BOTH NEAR & FAR			E 20's					
10 C						WEARS CONTACTS, NO FURTHER QUESTIONS NOT COUNTED				E 20's				Data removed pursuant to request of "the medRxiv team ". See text box, p.17.	
11 C						WEARS CONTACTS, NO FURTHER QUESTIONS NOT COUNTED				E 20's					
12 B-UV	24-120 [60] *1.78*	2-10[6][211]	360	2.556	S	LOOKS AROUND BES MIDRASH[212]	1 EYE GOOD, NEAR & FAR; 1 EYE -4D			E 20's					
13 B			0 [1][207 -B]	0	P	LEARNS ALONE 3-4 HRS STRAIGHT – NO BREAKS EXCEPT LUNCH, ETC.	BOTH EYES GOOD, NEAR & FAR, NO CONTACTS, NO SURGERY			E 20's			[227]		
14 B-UV			0 [1][207 -B]	0	S	NO BREAKS EXCEPT LUNCH, ETC	1 EYE GOOD FOR NEAR, 1 FOR DRIVING			E 20's					
15 C						NO Q'S RE BREAKS OR UV – BUT SOME INFO ON CONTACTS				E 20's			[228]		
16 B-UV	60-120 [90] *1.95*	30	180	2.255	S	NO GLASSES/CONTACTS/ SURGERY	1 EYE GOOD NEAR & FAR, 1 GOOD ONLY NEAR.			20's					
17 M	2-3 *0.40*	3	[50][213]			NOT WEARING GLASSES OR CONT-ACTS BUT MYOPIC NOT COUNTED				~25					
18 B			0[214][1][207-B]	0	S	NO BREAKS, TO LOOK AT CLOCK , AROUND YESHIVA , THROUGH PAGE,	USES BOTH EYES – BALANCED			E 20's			[229]		
19 B-UV!	120 [60] *1.78*	120[215]	60	1.778	S	DIDN'T WEAR GLASSES- BUT WAS WITH OTHERS WHO DID [216]	PROBABLY BOTH EYES GOOD			E 20's					
20 B	60 *1.78*	20	180[217]	2.255	S	LOOKS AT CLOCK & AROUND BES MIDRASH	BOTH EYES GOOD & WORK TOGETHER			E 20's					
21 C						WEARS CONTACTS, NO FURTHER QUESTIONS NOT COUNTED				E 20's					
22 B	10 E *1.00*	30 E [218]	20	1.301	S	LOOKING AROUND BES MIDRASH & AT CLOCK	EYES WORK TOGETHER			E 20's					
23 B	120 *2.08*	20	360	2.556		LOOKING AROUND THE BES MIDRASH	EYES WORK TOGETHER [230]			E 20's					
24 B	15 *1.18*	4-5	200	2.301	S	LOOKING AROUND THE BES MIDRASH	BALANCED			23?				[231]	
25 [B? no UV]	RELUCTANT TO ANSWER ANY MORE QUESTIONS – INCLUDING ON BREAKS --AFTER I SHOWED HIM THE FIRST PAGE OF THE SUMMARY OF THESE RESULTS.						EYES WORK TOGETHER			E20's					
26 B	15-50 [32.5] *1.51*	[10][219]	325	2.512	S	LOOKING AT DISTANT THINGS , NOT SPECIFIED	EYES WORK TOGETHER			E20's					

NUMBER	12 ≥25 sec/h [incl. 2 from table B]		14	14	10	
SUM	16.28		1865	22.848		
MEDIAN	1.51,1.78		60	1.778		
MODE	1.78		60	1.778		
RANGE	0.24-2.08		0-360	0, 2.56		
AVG	1.357 , ANTILOG = 22.7 sec		133.2	1.632		ANTI-LOG =42.85 SEC/H
SD	0.711 , ANTILOG = 4.5 sec.		±134.7	0.956		ANTI-LOG = ± 9.04 SEC/H

15 B[Break data] , 4 C[Contact lenses], 2 M[Myopic], 2 R, 6 UV[Unbal. Vision], 3 B-UV; 2 B-UV?; 1 B-UV!; 1 B? No UV

[206] In order in which the interviews occurred. R= Refused Interview

[207] A. Log DVB time eliminates problem of DVB with 'negative time'. B. Since $\log_{10}$ 0 is 'undefined', & 'none' here is a product of language, communication & vision, use, *pro forma*, 1sec: ~time 20y old in good light accommodates 2.5D, one way.

[208] 1st time that I heard of anyone taking such short breaks

[209] Not aware of UV issue for 1st several interviews. My sense of the interv. is that he was clearly talking about being able to see clearly near & far—This was the 1st question I asked. *[I didn't ask if this was for both eyes]*

[210] Checked his vision – after experience with # 7- by asking him to read clock about 20 meters distant.

[211] [6] is # of breaks/h, 2-10 is minutes from start of one break to start of next.

[212]

[213] Data removed pursuant to request of "the medRxiv team ". See text box. p.17.

A.Colenbrander,'Visual Standards…'02

[214] Data removed pursuant to request of "the medRxiv team ". See text box, p.17.

[215] Not clear if 2 hrs betw. breaks or total of breaks in 2 hrs=2 min. Use 1 min/h.

[216]

[217] Data removed pursuant to request of "the medRxiv team ". See text box, p.17.

[218]

[219] [10]=Number of breaks per hour .

[220] E20's:Early 20's;M:Medium;S:strong or short; NF:Not Fat;T:taller than avg.

[221] A= All, B= Brothers, F= Father, G= glasses, M=Mother, N=none, S=some

[222] sees well at distance & for reading. *[I didn't ask if this was for both eyes]*

[223] Assume this was 'to look around the room' like #5, not to look at cell phone, like #14 & [possibly] #15 in USES GLASSES [GROUP B] Comments about spontaneity & my sense on 1st hearing, strongly support that he was talking about looking around Bes Midrash, the clock, etc., not at cell phone .

[224] Re-interviewed by phone -no UV, no cousin who looks somewhat like him [I was hoping that he knew #3, supra]

[225] Not same as #2. Interv., Motzei Shab, a week later than #2. Resemblance of #5 & 2 was very great & identical breaks. Some students have close doubles who aren't siblings. Part of similarity is almost identical clothing & hair-cuts.

[226]

[227]

[228] Data removed pursuant to request of "the medRxiv team ". See text box, p.17.

[229]

[230]

[231]

TABLE B DATA FROM INTERVIEWS WITH "BRISK" STUDENTS WHO WEAR GLASSES OR CONTACTS

A.S. ADLER, JERUSALEM 7/29/ -9/14/ -10/05 / -12/02 2019 / F/9/2020 ashadler@yahoo.com

INTER-VIEW #	CURRENT PRESCRIPT'N: D LOWER	HIGHER	AVG.	RATE OF CHANGE -D/YEAR[232]	IDV BREAKS [LOG 10 EA. BREAK ,SEC.]	SEC/H	LOG	AGE[258]	HEIGHT	BUILD	UNBAL. VISION?	HEALTH	SHUCKLES	CORRELATION[260] [GOOD IDV & RATE]	COMMENTS
1				0.137e[258]	'Never takes breaks'[233]	1[233]	0[234]	21			NO	YES[261]	NAORV[262]	-	
2			[235]	0.3125e	'No breaks'	1	0[234]	E20's			NO	NDH[263]	NAORV	+	
3				Ndr[258]	'No breaks'	1	0[234]	NN			NO	NO	NAORV		
4				.	2 min/2hrs		[234]	NN			?	NDH	NAORV	TRANSFER TO 'NO GLASSES'[264] 1IW[265]	
5	Data removed			0.60	No[236]	1	0[234]	NN	Data		NO	YES[266]	NAORV	+	WEARS CONTACTS, 2 IW
6				0.625e	'No breaks'	1	0[234]	NN			NO		NAORV	+	
7	pursuant to			0.625e	20 sec/hr[237] E[238] 30[239]	30.0	1.477	NN	removed		NO	NDH	NAORV	-	
8	request of			Refused : Seemed to be in a rush				E20's					NAORV		
9				0.114e	?[240]	?	?	NN	pursuant to		NO	YES[267]	NAORV		3+ IW
10				0.45	10sec/hr[241] E 15[239]	15.0	1.176	NN	request of		NO	YES[268]	NAORV	+	4 IW
11	"the medRxiv			0.50	2 sec/hr[242] E	2.0	0.301	E20's	"the medRxiv		NO	YES[269]	NAORV	+	
12	team ".			0.114e	10 sec./hr[243] E 15[239]	15.0	1.176	NN	team ".		NO	NDH	NAORV	+	
13				0.096e	2 sec/hr[244]	2.0	0.301	E20's			NO	NO	YES	-	
14		[245]		0.00 [EYES +&-]	1 sec /hr[246]	1.5	0.176	NN			NO[270]	NO	YES	+	USES BOTH EYES[271] 2 IW
15	See text box,			0.393e	2-3[use 2.5] sec/5min[247] 6E	6	0.778	NN	See text box,		NO	YES[272]	YES		LOOKING AT PHONE?
16				Refused				NN							
17	p.17			0.25	20 sec/hr[248] E 30[239]	30.0	1.477	22	p.17.		NO	YES[273]	YES[274]	+	
18				0.625e	'No breaks'[249]	1	0	NN			NO	YES[275]	NO	+	USES BOTH EYES
19		[250]		Ndr [use 0.1 e]	2 sec . 2 times /h[251]	4.0	0.602	NN			NO	NO	YES – A BIT	+	-0.1D/Y IN CALC. AT 122B
20		[252]		0 [or.25][252]	3 sec/hr	[3.0]	[0.477]	26[276]			NO	NO	NAORV		DON'T USE 252 & 276
21				0.00	1.5-2sec [.24] every 3-5 min=18-40[253]	29.0	1.462	E20's			NO	NDH	NAORV	+	
22				0.667 [ok][254]	~1.25 sec. 12 times /h	15.0	1.176	E20's			NO	NDH	NAORV	-	[277]
23				0.00	~60 sec. [1.78] ~ 5 times/h	300.0	2.477	E20's			NO	NO	NAORV	+	[278]
24				0.17[255]	90 sec, 4×/h[256]	360.0	2.556	E20's			NO	YES[279]	NAORV	+	[280]
number		20		15[no 0]	6 [no 'e' or 0]	19	19				19 'NO'	9Y, 6N		17	5 WITH IW
sum		-79.95		5.6785	2.640	780.5	15.135							13+	
range		-0.50, -9.25		.096,.667	.17,.667	1[.3]	360.0		Σ					4 -	
median		-3.75,-3.75		.393	.45,.50	4.0	0.602								
mode		2.25,2.5,3.75,5.5		0.625	none	1[.3]0									
avg[257]		-3.998D		0.3786	.440	Antilog avg 19= 6.260 sec/h	41.6	0.7966							
s.d.		±2.257D		0.2199	0.1956	https://www.calculator.net/st		0.8314							
FOOT-NOTE				111	101	16 with DVB data &WMincl ndr[*italics*]SUM=11.020 avg=0.689, Antilog=4.886 SEC/H, SD=.7574									
						16 WM[italics], MEDIAN 2.0 SEC, MODE, 0 SEC									

[232] See footnote 103.d for computation of estimated values. Value shown is for eye with higher rate of worsening. This is the most important for measurability of change.

[233] Students take breaks for meals & prayers early & late PM. May only incl. a small % of "DVB" time compared with break length. For $\log_{10}$ calculations,1sec/h is used where student said ~'none'. 0.3 is used in ∑ & sd instead of 0 at sec/h[See footnote 207]

[234] See §5.1.b.i in reference to apparently unusual sequence of 5 zeros in a row.

[235] Not clear if these 2 #'s were for ea. of 2 eyes or 'before & after' time period.

[236] Data removed pursuant to request of "the medRxiv team ". See text box, p.17

[237]

[238] Length, freq. & type of break involve some estimation/interpolations as a result of limited information provided or illegible writing.

[239] This value is based on the weighted probabilities of alternative values and is 1.5× the original best single value estimate. See section 5.2b, 5-20 sec/h.

[240] *several words unclear, can't read my writing!* Try to read again .

[241]

[see footnote 233 on breaks for meals, etc.] [242] Data removed pursuant to request of "the medRxiv team ". See text box, p.17

[243]

[244]

[245] This level of difference between eyes almost always goes with complete lack of stereopsis - the eyes don't work together in the usual way. See Fig 4, p.12

[246]

[247]

[248] Data removed pursuant to request of "the medRxiv team ". See text box, p.17

[249]

[250]

[251]

[252]

[253]

[254] Unusual fraction…. Correctly calculated.

[255] Data removed pursuant to request of "the medRxiv team ". See text box, p.17

[256]

[257] Excludes #4 which, switched to non-myopic- no glasses group.

[258] e= Estimated: interval between measures not clear – see interview details. E20's:Early 20's, M:Medium, NDH:No Data on Health, Ndr:No data on rate, NF:Not Fat, NN:Not Noted, S:Short or Slight build; SF:Slightly Fat

[259] None of those who were asked ~"Did anyone give you any advice on eye health?" mentioned taking any eye breaks. 4 - with NDH -were not asked , 5, incl. one transferred to the "no glasses" study.[see footnote 229]

[260] [+][if myopia rate>avg & DVB<avg[or no UV] or vice versa]; [-]if opposite.

[261] mother said eat orange & yellow fruits & vegies & don't read in the dark.

[262] NAorV= Not Asked or Volunteered. The question on shuckling wasn't asked until interview 13 in this series & wasn't asked of the non-myopes.

[263] No Data on Health advice/practices other than what's shown

[264] *Student didn't wear glasses*– see details of interview [Interviewed with glasses wearing students interested in causes of myopia. Switched to #19, "no glasses" group, tho. interviewed before #18 in that group.

[265] Number of Illegible Words in notes of interv'w – written with shaky hands in 3x4in hard cov. notebook, standing, facing & talking with student. See p.11: photo of page from interview notebook with such illegible words.

[266] *Told not to strain his eyes,*

[267] *Told to keep reading distance to ≥40 cm– elbow to proximal knuckles.*

[268] *Was told don't read in the dark, [Don't use glasses for reading [?This is unclear because of the way I wrote it*]

[269] *Doesn't read in the dark, 1/2 of family has glasses*

[270]

[271]

[272]

[273]

[274] *[word not clear]*

[275]

[276]

[277] Data removed pursuant to request of "the medRxiv team ". See text box, p.17

[278]

This raises the question of what other students were doing in prior years—both those that had myopia and those that didn't.

[279] Data removed pursuant to request of "the medRxiv team ". See text box, p.17

[280]

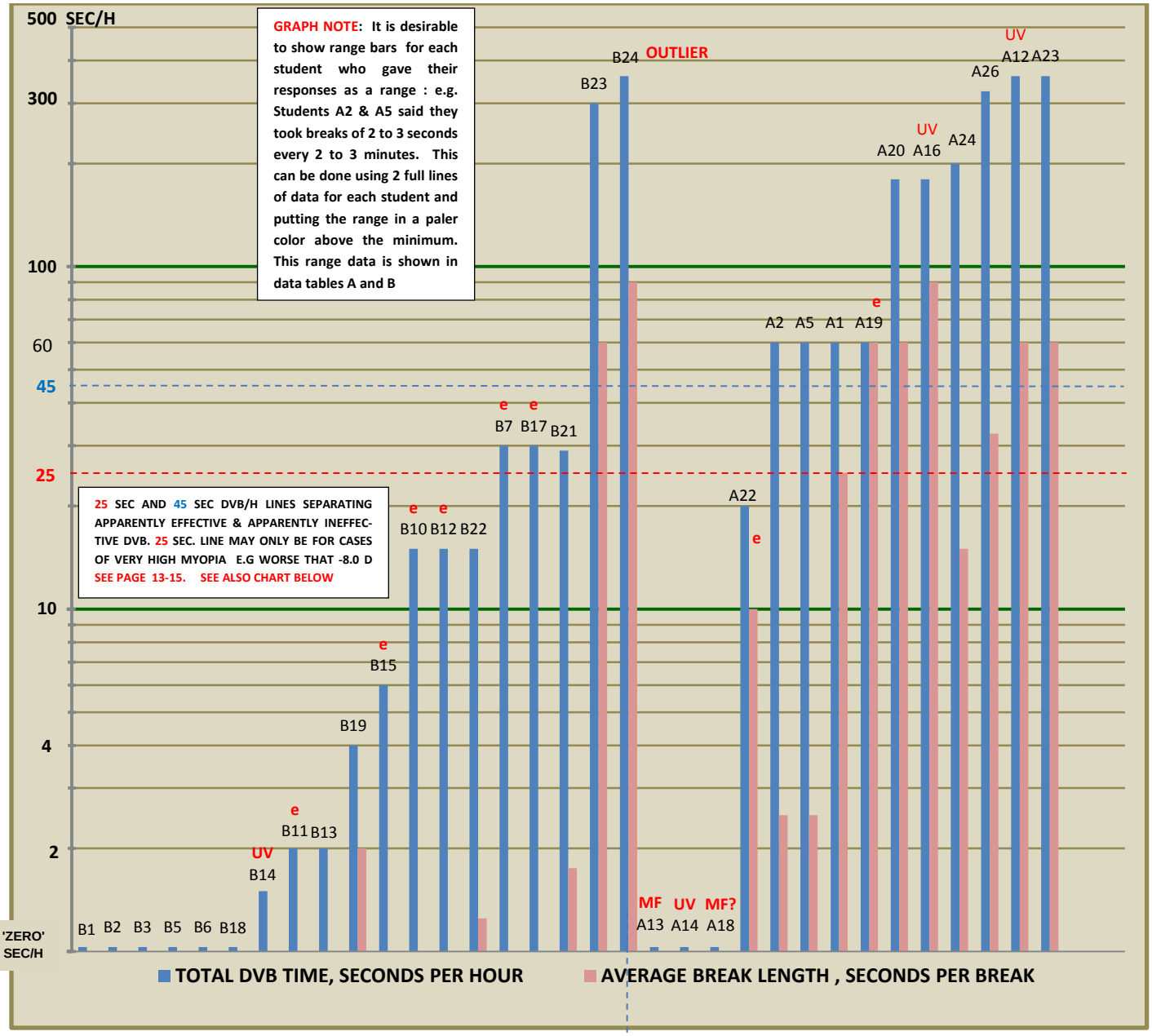
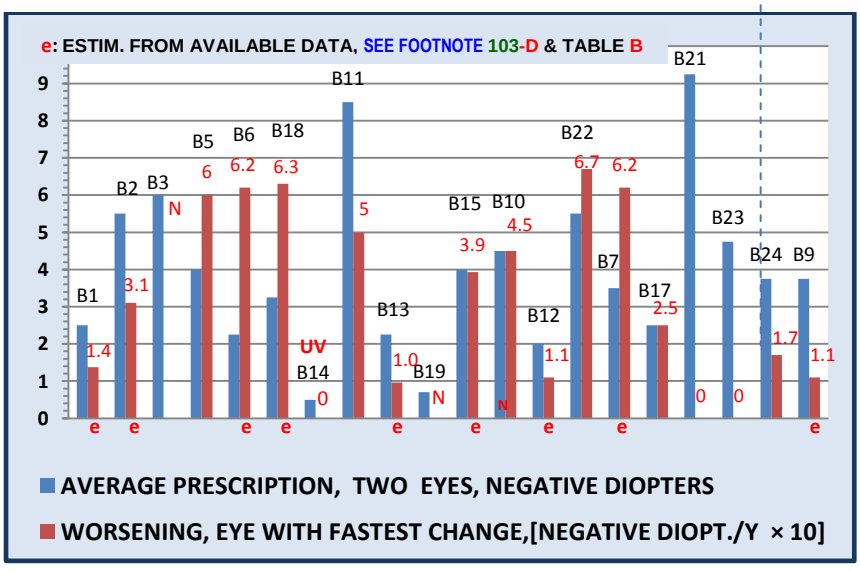

500 SEC/H
300
100
60
45
25
10
4
2
'ZERO' SEC/H
GRAPH NOTE: It is desirable to show range bars for each student who gave their responses as a range : e.g. Students A2 & A5 said they took breaks of 2 to 3 seconds every 2 to 3 minutes. This can be done using 2 full lines of data for each student and putting the range in a paler color above the minimum. This range data is shown in data tables A and B
25 SEC AND 45 SEC DVB/H LINES SEPARATING APPARENTLY EFFECTIVE & APPARENTLY INEFFECTIVE DVB. 25 SEC. LINE MAY ONLY BE FOR CASES OF VERY HIGH MYOPIA E.G WORSE THAT -8.0 D
SEE PAGE 13-15. SEE ALSO CHART BELOW
B1 B2 B3 B5 B6 B18 UV B14 e B11 B13 B19 e B15 e B10 e B12 B22 e e B7 B17 B21 B24 OUTLIER B23 MF A13 UV A14 MF? A18 A22 e A2 A5 A1 e A19 UV A20 UV A16 A24 A26 UV A12 A23
TOTAL DVB TIME, SECONDS PER HOUR
AVERAGE BREAK LENGTH , SECONDS PER BREAK

FIGURE 1 DISTANCE VIEWING BREAK [DVB] TIME OF MYOPES, B, LEFT AND NON MYOPES, A, RIGHT
NUMBERS ABOVE BARS REFER TO INTERVIEWS IN TABLES A AND B, IN SEQUENTIAL ORDER OF INTERVIEW.
"UV" ABOVE A NUMBER INDICATES UNBALANCED VISION; e Estimated; MF Myopia Free Family; N No Data


e: ESTIM. FROM AVAILABLE DATA, SEE FOOTNOTE 103-D & TABLE B
B1 1.4 B2 3.1 B3 N B5 6 B6 6.2 B18 6.3 UV B14 0 B11 5 B13 1.0 B19 N B15 3.9 B10 4.5 N B12 1.1 B22 6.7 B7 6.2 B17 2.5 B21 0 B23 0 B24 1.7 B9 1.1
AVERAGE PRESCRIPTION, TWO EYES, NEGATIVE DIOPTERS
WORSENING, EYE WITH FASTEST CHANGE,[NEGATIVE DIOPT./Y × 10]

The Association Between Habitual, Short, Distance Viewing Breaks During Reading and the Advancement of Myopia In Reading Intensive, College-Age Men

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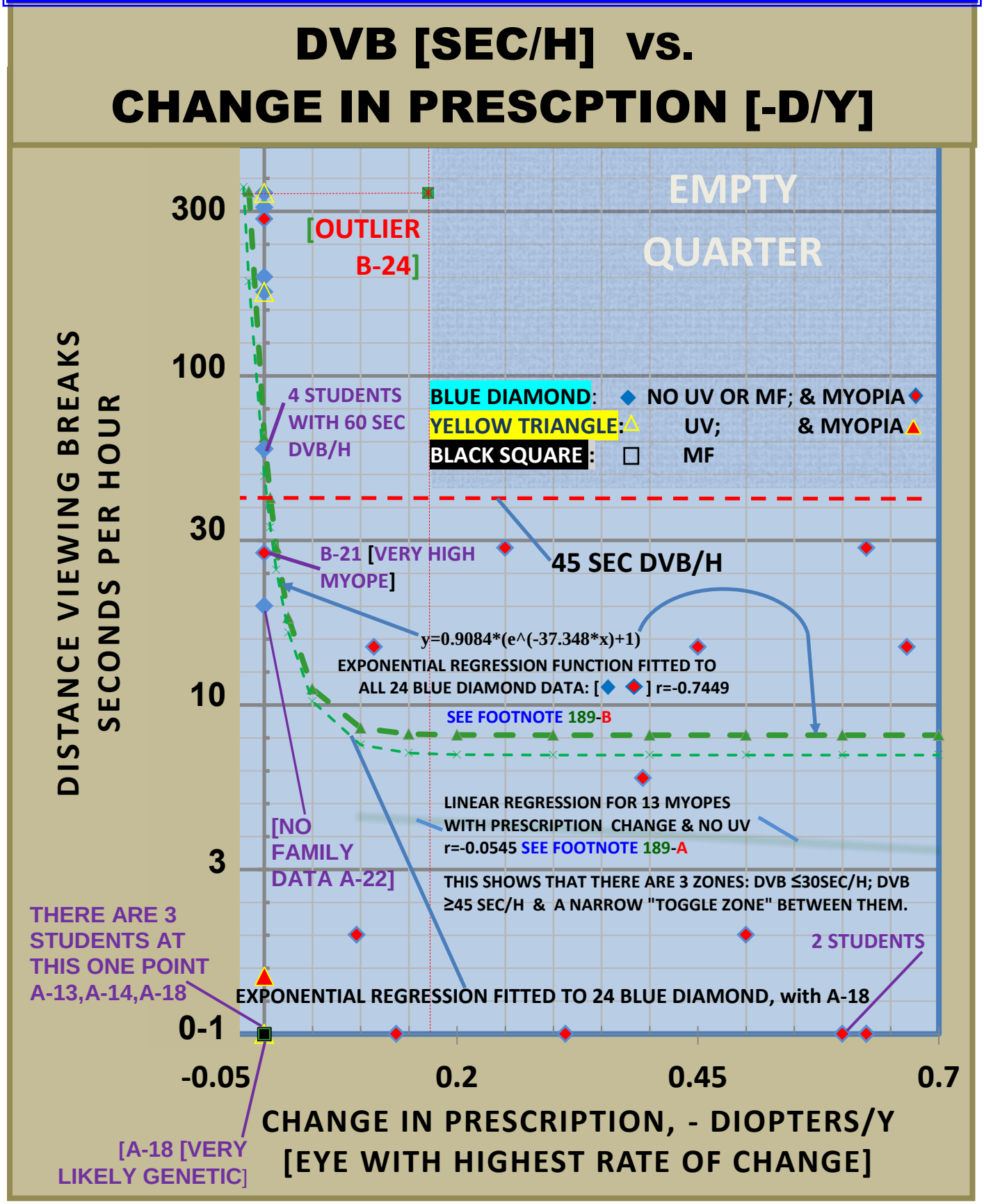
Jun. 1, 21

The Association Between Habitual, Short, Distance Viewing Breaks During Reading and the Advancement of Myopia in Reading Intensive, College-Age Men

[A.S. Adler,[Independent Researcher, Jerusalem] avshadler@yahoo.com [Jun. 1, 21]

DVB [SEC/H] vs. CHANGE IN PRESCPTION [-D/Y]


EMPTY QUARTER
[OUTLIER B-24]
300
100
30
10
3
0-1
-0.05
0.2
0.45
0.7
DISTANCE VIEWING BREAKS SECONDS PER HOUR
4 STUDENTS WITH 60 SEC DVB/H
BLUE DIAMOND: NO UV OR MF; & MYOPIA
YELLOW TRIANGLE: UV; & MYOPIA
BLACK SQUARE: MF
45 SEC DVB/H
B-21 [VERY HIGH MYOPE]
y=0.9084*(e^(-37.348*x)+1)
EXPONENTIAL REGRESSION FUNCTION FITTED TO ALL 24 BLUE DIAMOND DATA: [ ] r=-0.7449
SEE FOOTNOTE 189-B
LINEAR REGRESSION FOR 13 MYOPES WITH PRESCRIPTION CHANGE & NO UV
r=-0.0545 SEE FOOTNOTE 189-A
[NO FAMILY DATA A-22]
THIS SHOWS THAT THERE ARE 3 ZONES: DVB ≤30SEC/H; DVB ≥45 SEC/H & A NARROW "TOGGLE ZONE" BETWEEN THEM.
THERE ARE 3 STUDENTS AT THIS ONE POINT A-13,A-14,A-18
2 STUDENTS
EXPONENTIAL REGRESSION FITTED TO 24 BLUE DIAMOND, with A-18
[A-18 [VERY LIKELY GENETIC]
CHANGE IN PRESCRIPTION, - DIOPTERS/Y
[EYE WITH HIGHEST RATE OF CHANGE]

Rates of change of myopia for 3 students [B1, B13 & B15] were re-estimated based on new data on 1st prescriptions. However, the new data may not be as good as the old & regressions haven't been re-run. The difference in curve fit & shape should be small. See footnotes 103.d, 109, 189.b & this graph & Excel Book. The best fit function is probably not the exponential function shown here but a "Toggle" function [R. Zhang, et al, 19; S. Meinhardt, et al, '13], with a narrow toggle zone from ~8 to ~40sec/h DVB.

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A BRIEF ACCOUNT OF HOW THE AUTHOR CAME TO WRITE THE ORIGINAL, ~3000 WORD '76 PAPER:

"Notes on Improving the Economic Vitality and Environmental Quality of New York City Through Coordinated Local Transportation Policy Changes"

Eighteen years after the events related below, I met Rabbi Yitschok Poupko, the last personal secretary of the Chofetz Chaim – perhaps the most universally loved and respected rabbi of the last several hundred years. Among the things R. Poupko taught me in the name of his great teacher was: "A true teacher of Torah encourages his students to ask questions and is not afraid of apparent contradictions." As will be seen, it was asking questions and recognizing apparent contractions that led to the discoveries in this and subsequent studies in several seemingly unrelated fields. It is a key to learning for the auto-didact – the person who teaches himself.

In January of '70, the NYC Transit Authority raised the basic transit fare for buses and subways by 50% -- from $0.20 to $0.30 – without any public hearings that the author was aware of. In the spirit of the Talmudic adage, "If not me, who? If not now, when?"* and non-violent protests against other, seemingly heavy-handed government policies – such as the then ongoing war in Indochina -- the author became involved with others in protesting the fare increase.

Then 17 years old, the author joined in civil disobedience actions in which subway station gates were held open and passengers were encouraged to go through the gates -- instead of the turnstiles – without paying their fare. In the course of these actions, the author was arrested and released four times in about 25 hours – probably more than anyone else in the City.

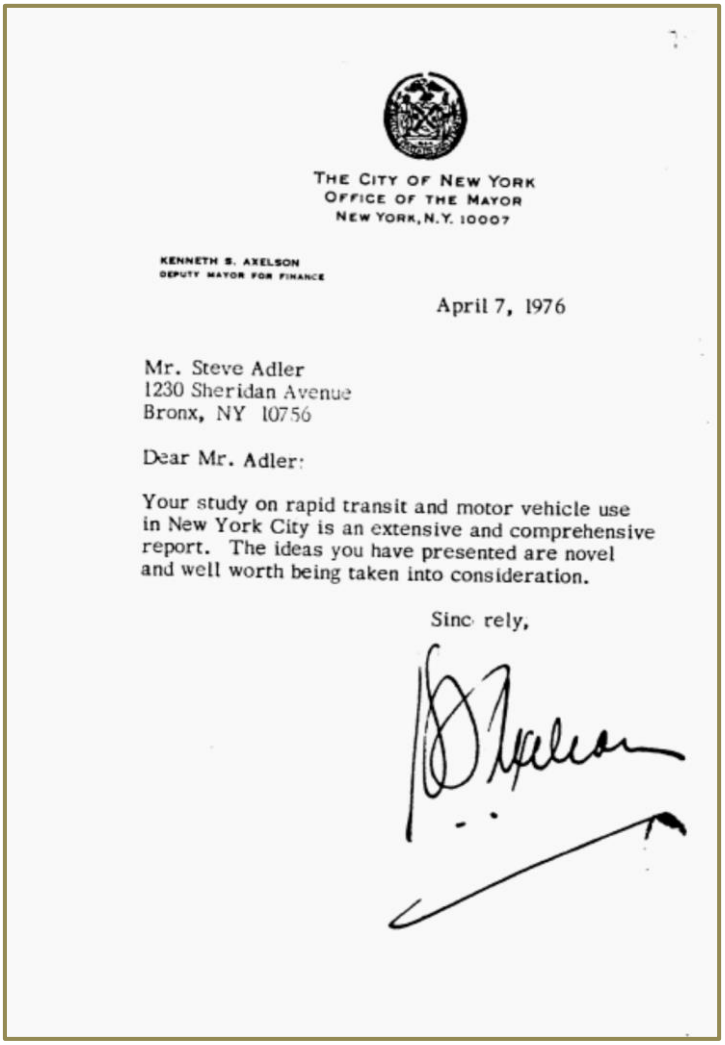
The slogan of the group that organized most of these actions – Youth Against War and Fascism (YAWF)– was "Tax the Banks! Not the People!" So the author asked one of the YAWF organizers – a man – I think his name was Chris-- who was a Columbia University graduate student:

~"What if you had two banks, equal in every way, except that one was located at Herald Square [in the city center & served by several subways & two railroads] & the other was at the south end of Staten Island [with little transit access]. Would you tax the two banks equally?" His answer was: "Yes… Because they have the same amount of money."

It seemed to the author though, that this was only taxing the bank with little benefit from the subways to support the bank that benefited a lot from them -- and was not reasonable or equitable. In fact, beyond their slogans, the YAWF people did not seem to know or care much about how to run or pay for the transit system.

However, the question of location related benefit led to the question of some kind of payment based on such benefit and then to the question of whether the subways might be operated free of direct passenger charges -- like elevators – and paid for by some special tax based on location related benefit.

This led immediately to two other questions: How much would be saved by eliminating fare collection costs – turnstiles, token booths, entry barriers, revenue collection trains, etc.? – and: How much would ridership – and crowding – increase, as a result of "free fare"?



THE CITY OF NEW YORK
OFFICE OF THE MAYOR
NEW YORK, N.Y. 10007

KENNETH S. AXELSON
DEPUTY MAYOR FOR FINANCE

April 7, 1976

Mr. Steve Adler
1230 Sheridan Avenue
Bronx, NY 10756

Dear Mr. Adler:

Your study on rapid transit and motor vehicle use in New York City is an extensive and comprehensive report. The ideas you have presented are novel and well worth being taken into consideration.

Sincerely,

To answer these questions, the author acquired a copy of the detailed operating budget of the Transit Authority and researched the literature on the impact of fare changes on transit ridership. The result was two discoveries that the author wasn't looking for: 1. The cost of operating transit buses per bus mile and per passenger mile appeared to be extremely high. And 2. The same literature that dealt with the effects of fare changes on ridership often also dealt with the effects on ridership of service frequency improvements.

Thus, when the extremely high cost of operating transit buses suggested -- to the author – the possibility of switching to owner-drivers using low-cost,10-15 seat vans, it was clear that the greatly in-creased service level associated with such a change might result in enough of an increase in ridership – diverted in large part from cars and taxis -- to offset congestion that might otherwise result from increasing the number of transit vehicles on the road. The detailed exploration of this possibility led to the author's re-search results – first widely published in 1976, and elaborated upon and updated in a 2008 report: [see p. 43 & 44]

PUBLIC & PRIVATE TRANSPORTATION, or: HOW TO MAKE AN HONEST TEN TRILLION DOLLARS **

[This was global real wealth created [assuming the annual benefits =3% of the real wealth], before the advent of GPS enabled cell phones. With these & total global growth in the value of time, it would be close to twice that in 2021.]

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* "…Hillel said: Be of the disciples of Aaron, loving peace and pursuing peace, loving your fellow creatures and bringing them close to the Torah. …He would also say: If I am not for myself, who is for me? And if I am only for myself, what am I? And if not now, when?" [Adapted from Hillel, Ethics of the Fathers, 1:12-1:14:

"...הלל אומר, הוי מתלמידיו של אהרון--אוהב שלום ורודף שלום, אוהב את הבריות ומקרבן לתורה. ... הוא היה אומר, אם אין אני לי, מי לי; וכשאני לעצמי, מה אני; ואם לא עכשיו, אימתי.

steve adler 2545 valentine ave. bronx, n.y. 10458 [1977] 2

NOTES ON IMPROVING THE ECONOMIC VITALITY AND ENVIRONMENTAL QUALITY OF NEW YORK CITY THROUGH COORDINATED LOCAL TRANSPORTATION POLICY CHANGES.....

Special Assessment Financing of Free Rapid Transit...short term solution

The principal benefit of rapid transit is convenience of access to diversity of opportunity and thus varies with location with respect to the transit system. The pattern of these benefits can be determined through statistical analysis of floorspace rents and land values. A special assessment can be levied on property in accordance with the pattern so revealed. Such assessments can be levied on property otherwise exempt from taxation, and when used to finance transit operating costs, would be federal income tax deductible. Properties most benefited by the rapid transit system are largely owned by corporations and wealthy individuals, thus, the percent shifted to the Federal Government could be high.

Because the annualized benefits of the subway to property are greater than it's combined capital and operating costs, the entire amount could be raised through special assessment. This means that the cost of fare collection could be eliminated and additional, even more significant benefits would be realized in the value of each additional transit trip, and in the diversion of auto trips to the system with the resultant reduction in noise and emissions damage and road congestion. These combined benefits--taking into account increased crowding, which would only be about five percent for the most crowded rush hour flows to and from the Central Business District--amount to over two hundred million dollars per year. These benefits are real and not merely a shifting of burdens.

As the benefits are real and significant and the method of financing is according to a market determined pattern, so that one is in effect paying for what one gets, a broad political base of support can probably be developed for this concept.

Currently, about ten percent of subway riders live in New York City suburbs. Under a free system, these suburbanites would save about fifty million dollars per year in subway fares in addition to about fifteen million dollars per year in benefits which would be received by suburban commuters in general in the form of reduced auto congestion, reduced air pollution, etc. Thus the special assessment district could reasonably be expected to extend beyond the borders of N.Y.C.

If the method of control of this special assessment district is that an individual's vote is proportional to benefit and thus to assessment level, and if only that pattern of operation which receives the highest unit vote (within certain reasonable administrative constraints) instead of merely a magority, becomes policy, the system will probably be operated to the greatest benefit of all and most of the political "difficulties" would be greatly reduced. Special assessment districts could also be developed for each individual line and station to deal with problems of a very local nature, such as station æsthetics, noise control, new entrances etc.

This pattern of financing and control would have the additional benefit of greatly increasing the concern and social activity of individual citizens and countering the current tendency toward social disintegration and destabilization --a greater sense of community would develop.

The Potential of Free Enterprise Surface Transit

The chief obstacles to the provision of economic public surface transportation are the monopoly-franchise bus laws and laws restricting entry into the taxicab business and regulating taxi fares. Eliminating these laws would probably result in the rapid development of a ubiquitous system of owner driven econoline type vehicles, that, because of inherent economies, would capture almost the entire intracity bus passenger market, and a sizable portion of the taxi passenger market as well as roughly twenty percent of intracity private auto travel.

The 3 documents on this page are, clockwise from the top left, most of the first page of a 5 page document similar to the outwardly un-prepossessing report that I handed, in person, to Kenneth Axelson, at City Hall in N.Y.C. [see p. 42 & 44] He was the first Deputy Mayor for Finance – working for $1/year- and tasked with getting the City out of functional bankruptcy. The rest of the document dealt with free enterprise surface transit, road user charges and a program of coordinating the introduction of these innovations. He was the only senior government official who ever responded with any substance to this or other reports on the subject that the I distributed over a period of 3 decades. Next, is a published discussion paper on the long-term effects of charging road users for the use of roads in intensely built-up urban areas. I attended the conference and handed out a version of the same paper that I gave to Kenneth Axelson. I didn't realize that they would publish what I sent in – and so, offered only the document you see here. They published it as a photo copy of my typed letter. At the conference, I met Gabriel Roth, one of the world's leading experts on road user charges, who has supported and promoted my ideas over the years. On the left is the text of an editorial reply on the issue of an open market for surface transit. I was told by ABC TV that it was broadcast 4 times – as usual for such things – and elicited no letters or calls from the millions who reportedly saw it. ABC told me that such "zero response" was usual for Editorial Re-plies. Years later – they told me that they erased the tape—which was also routine! The document on the next page – on the same subject--was initially prepared for an official of the NYC's Bloomberg Administration in 2007 and submitted in revised form at a hearing later that year.

WABC-TV

EDITORIAL REPLY

NO. 51 – 1982

STEVE ADLER, A CONCERNED NEW YORK CITY RESIDENT

In a recent editorial, Channel 7 supported the commuter's right to choose between van services provided by enterprising private operators and express bus service supplied by city monoplies. Why only commuters?

Through the city, informal local van services are springing up, providing fast, reliable, token-priced service for thousands of daily riders. With all the pundits saying local transit must be subsidized, how do they do it? It's quite simple.

The low van purchase and running costs and relatively low skill levels required to drive a van, combined with far lower overhead and greater flexibility make it possible for a van to operate for about one third the cost per mile of MTA buses. This enables them to make money on routes where lightly utilized bus service would lose several dollars per mile. On average bus routes, vans can provide about three times the frequency of service, carry the load, and still avoid red ink.

Far from adding to congestion, this increased service level tends to attract people out of cars and taxis – reducing the overall traffic, pollution, energy problem.

Knowing this, we can phase out our most money-losing bus routes, permit vans to fill the void and use the millions of tax dollars saved to restore our crumbling subways.

• • • • • • •

TELECAST: NOVEMBER 8, 9, 1982

CART NO. 9016

CLIFF LOVE – EDITORIAL DIRECTOR

BILL FYFFE VICE PRESIDENT AND GENERAL MANAGER
WABC-TV 7 LINCOLN SQUARE, NEW YORK, NEW YORK 10023 212 887-3068
WABC-TV broadcasts daily editorials on topics of vital community concern
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12

Proceedings of the Specialty Conference on

Urban Transportation Efficiency

Sponsored by:
Urban Transportation Division of A.S.C.E.
Co-sponsored by:
Institute of Transportation Engineers and
Transportation Research Board

Published with the support of the Urban Mass Transportation Administration U.S. Dept. of Transportation

New York, N.Y.
July 26-27, 1976

Published by the American Society of Civil Engineers
345 East 47th Street
New York, N.Y. 10017

URBAN TRAVEL ECONOMIC COSTS
Marshall F. Reed, Jr. 68

Discussion by Steve Adler 76

In analyzing motor vehicle costs, the land cost of expressways is included while the land cost of existing urban local and arterial streets is not. By including the land cost of widening existing urban arterials, Mr. Reed recognizes that such roadway expansion displaces possible alterative uses. All roadways, and for that matter all other land uses, displace alternative land use opportunities. At the same time, by affecting accessability, roads affect the rental value of surrounding land. Where this effect is positive, the owners of such land should be prepared to pay for the road right-of-way an amount up to the difference between the rental value of their land with and without the road. Motor vehicle users should also be willing to pay a road rent less than or equal to the benefits to them with and without the road. The street should be used as a roadway where the road rent from both land owners and motor vehicle users combined, exceeds the rent offered for the street space by alternative users - assuming for simplicity, that the external impact of such alternatives is neutral.

The very process of weighing the rental cost of the road against the benefits of increased accessability, would raise economic pressures to develop such alternate means of access as would produce a more favorable access cost to benefit ratio. For example: The real estate industry in high density areas may discover that a more favorable ratio would be produced if conventional roads were replaced with multi-story structures having motorways, pipe galleries, enclosed shopping concourses and open air parkwalks on different levels. Putting the motorway on a lower level would require expensive ventilation, while putting the motorway above grade would require costly extra-heavy construction. Thus, in addition to space constraints which would encourage the adoption of access sytems with high capacity/space ratios, economic pressures would stimulate development of more lightweight transport with lower ventilation needs. To the extent that motor vehicle users are charged road-rent directly, they also will seek a more favorable access cost benefit ratio by increasing the load factors of their vehicles, by avoiding through routes where lower cost peripheral alternates are available, by reducing the amount of on-street parking, etc.

While the land cost of local and arterial streets per vmt is low for outlying areas, judging by the rents paid for shallow stores fronting on 5 and 6 lane streets in Mid-town Manhattan, it can rise to well over $1.00 per vmt in core CBD areas.

Acceptable social techniques must be developed to reflect these wide cost variations in the decision making processes of road users and to incorporate such road-space allocation techniques into the more general market for all urban space uses.

כז ב׳ סִיָּן תשע״ה AS THOU GOEST BY THE WAY ובלכתך בדרך ב״ה

JITNEY SYSTEMS & AUTO RAPID TRANSIT[1] – WITH KIRUVANS™ & KINDNESS CARS™ AS A PATH TO PEACE

ABSTRACT: An open market for surface transit in NYC would lead to the creation of a ubiquitous system of largely owner-driven, van-size vehicles & cars with >10X the service frequency & net benefits >$15E9/yr[2]. These benefits include a ~15% net drop in citywide VMT[3] & even greater declines in travel related pollution & energy consumption. Applying this policy in the USA & globally would yield net benefits of ~$0.15 & $0.5E12/yr.[2], respectively, along with improvements in social organization.

A.S. Adler, Specific numbers as of 10/16/'07. [text revised Jul23/15]. The full draft report of ~40K words on which this summary is based may be obtained at no charge from the author in pdf form by writing to vantran613@yahoo.com.
[Numbers in parentheses ref. to pages in full report – draft 8.20pdf.]

A van-size **JITNEY** providing safe, local bus service in NYC was estimated to cost ~$3.00/vehicle mile(**10-13**).

For the sake of a preliminary analysis, it's assumed that the small, frequent, largely owner-driven vehicles will be 'self-organizing'. This eliminates the usual costs of dispatchers, supervisors, & other management overheads that come with conventional local urban bus operations.

With this **JITNEY** unit cost, *sans* conventional overhead, **JITNEY** systems in NYC local bus service can provide >3X the number of vehicle miles, a 25% increase in in-vehicle speed & a seat for all. They can do all of this while carrying all existing bus riders, charging the same average fare & receiving no subsidy. The relatively high frequency of service -- even before diversions from cars & taxis - & the high responsiveness, enable the **JITNEYS** to 'self-organize, as already assumed. If they're allowed to compete with conventional 'large bus' operations, the **JITNEYS** would almost always win.(**13-14**)

With a >3X increase in service level, the **JITNEY** systems attract people out of cars, taxis & even subways, roughly doubling total demand. To serve this new demand, **JITNEY** frequency would rise to >6X that of the original local buses. This 'virtuous circle effect' continues -- though at a rapidly declining rate (**16-17**). When combined with **Auto Rapid Transit [ART**[1]**]** (**45-53**), there would be much more than a 10X increase in equivalent service frequency -- with major reductions in waiting, walking & riding time.

There are also sizable consumer surpluses for those diverting from other modes (**16-21**) & small reductions in subway crowding (**24-30**). This comes with large net reductions in congestion, pollution & energy consumption - probably greater than what might be achieved with an efficient congestion charging program (**53-59**).

GPS-enabled cellphone services would increase **ART** frequency several fold, make **JITNEY-ART** services even more efficient – including low cost rapid [≤1 hr.] package delivery & add billions of dollars in annual benefits – above the $15 billion per year cited in the abstract.

1. **Auto Rapid Transit** or **ART** is where drivers traveling to work, school, mall, etc. pick up passengers free or for a small fee on their way.
2. AS of 7/'15, revised to **$22E9 NYC**, **$260E9 USA** & **$850E9+ Global**
3. **VMT** = car equivalent **V**ehicle **M**iles **T**raveled.

Regulation need not be governmental but can be handled more like hekshers on kosher food. Insurers, for example, could combine with organizations that certify the nature and integrity of services, drivers and would-be riders. They could issue cellphone/GPS verifiable certificates to those who qualify. Many certifiers – even thousands -- could operate in one area & multiple hekshers could be held by a given service or person.

GPS/cellphone based info. system can be used to provide real time, location based, on-street/in-vehicle services to **JITNEY/ART** riders & drivers -- including news, advertising & community organizing information - in addition to time critical travel related material. This can be supported by a combination of advertising & charges associated with the incremental value of such services.

With GPS, accident insurance rates can be more according to risk: by time, place, distance & vehicle occupants. They can be set much higher per mile in congested corridors[4] -- pricing accident prone drivers & breakdown prone vehicles out of the congested areas.

To reduce opposition from bus operators & medallion taxi owners (**21**), the **JITNEY/ART** program could take advantage of some notable gaps in New York City's bus services. For example, some very congested roads -- like Park Avenue in Manhattan -- have no bus service at all because the road is too weak to carry heavy vehicles. ***Kiruvans***™ could be operated on these routes, providing donation-based van services to people who'd like to learn enroute about a particular religion, ideology or idea. The ***Kiruvans*** could also demonstrate new types of, wheelchair accessible[5], "zero pollution" vehicles & new ways of donation/fare collection.

Beyond this, networks of ***Kindness Cars***™ & then competitive/cooperative groups of **JITNEY/ART** user's & operators could use GPS, cellphones & the Web to bypass the conventional regulatory agencies. Like ***Kiruvans***, they'd provide excellent services without waiting for approval from the people who protect the status quo.

The system can be used to promote peace where there is real or potential conflict. On the Jerusalem – Mearas Hamachpela [מערת-המכפלה]/Chevron route, where people come from all over & trampiatas, hitchhiking & GPS'd phones are common, it could build on the '70 languages' of Avroham Avinu. With 70 languages, dictators – like Nimrod & their dehumanizing programs - are defeated, while **Avroham & his Children can promote TORAH: THE WAYS OF KINDNESS & TRUTH, MODESTY & PEACE.**

4. **Accidents & breakdowns are among the key causes of congestion.**
5. For analysis of **wheel chair accessible JITNEYS**, see **sec.** 10c p.31-3.

TM: ***Kiruvans*** bring people closer to both a way of seeing the world and to a place in the world. ***Kindness Cars*** are **ART** with a 'suggested donation' below market rates. **TM**'s of A.S.(Steve) Adler. The ideas of ***Kiruvans*** & ***Kindness Cars*** or "hachnosas orchim in a car" were inspired, in part, by conversations with large-scale developers, B.& R. G., NYC, '12.

FROM TRANSPORTATION POLICY TO THE PERSONAL READER

My research on transportation policy between 1970 and 1976 involved studying many technical reports that were published on microfiche – mostly by NTIS: the National Technical Information Service of the USA.

Once, while walking in mid-Manhattan, I found a piece of microfiche in the street. It was part of a computer data list – with no recognizable ID. I took it home and looked at it under a low cost "toy" plastic microscope of about 20× magnification. To my surprise, the image was much sharper and brighter- with far better contrast - than what I'd found with the projection-based microfiche readers I had used in libraries. It also had an intense blue color – not like the washed-out colors seen with the library machines.

I immediately thought of making a microfiche reader based on a microscope. It would be lightweight, compact, have a folded optical path and be designed to be worn on the face for use with both eyes. It seemed like an obvious idea, I thought I could just buy one off the shelf. But the largest micrographics store in NYC didn't have it.

The nearest thing was a monocular souped-up magnifier. It had bright, sharp, clear imagery and the intense color I'd experienced with the toy microscope - but unless the device was well centered on the eye, the imagery was terrible. Magnification was also limited –not enough for the 60X microbooks & 90X ultrafiche that were then coming on stream. The store owner told me there was an expert on personal portable microfiche readers in New York City – George Margolin. He said I should speak with him about a microscope based device.[203-A]

At left is the latest – 2015 - version of a summary of my jitney study prepared in 2007.[202-A][See also p. 43] At 2021, the numbers in note 2 should be increased by at least 15%.

At lower left [A] is the only 100% non-confidential part of the eight page report of David Grey.[203-B] Below [B] is Polaroid's rejection letter.[203-C,D]

A

Summary Report on a New Type of Wearable Microscope
For Microfiche Reading
4-29-83

The problem of developing a broadly acceptable personal microfiche reader has been on the agenda of the optical design community for decades. Would-be solutions involving compact, wearable compound microscopes have been around since the late 30's.[1] Such "solutions" coming almost entirely from people outside of Optics, appear at first look to be highly promising. They seem to combine the characteristics of extreme portability, low cost and the potential for sharp, readable binocular imagery. But it's not so simple.

A microscope suitable for comfortable reading must be very different from conventional systems which are designed only for viewing and photography. A reading microscope should allow the user to roll his eyes in scanning each successive line of print rather than forcing him to engage in the sort of constant back and forth head movements that would be required when reading through a conventional microscope. It must also give visual access to the entire page image regardless of the point of attention. All my experience in visual instruments indicated that these features are essential to minimize visual and mental fatigue.

1. For instance: Ralph D. Bennett, Sheet Microfilm, Advantages, Techniques Costs - report to Dr. Irwin Stewart, Director of the Committee on Scientific Aids to Learning of the National Research Council (U.S.A.) Aug. 25, 1939; & Verneur Pratt, U.S. Patent #2,485,411 (1949).

B

POLAROID CORPORATION
CAMBRIDGE, MASSACHUSETTS 02139

October 21, 1983

Mr. Steven Adler
79 Bertwell Road
Lexington, MA 02173

Dear Mr. Adler:

As we discussed, Polaroid's corporate strategy does not accommodate a microfiche reader or the development of a microfilm business. While we are impressed with the innovation contained in your microfiche reader, and agree that it is probably manufacturable at the approximate cost; we have considered this is not a market we wish to enter. We are not questioning the potential of the product, it just does not fit into our long-term strategy.

The product and the marketing project that will follow look exciting and worthwhile, unfortunately we will not be able to participate with you, but I am sure you will be successful in your endeavor.

Thank you for giving Polaroid the opportunity to consider your proposal.

Yours truly,

Ronald R. O'Connor

Ronald R. O'Connor
Director
Visual Communications

RROC:hem
attach.

CC: S. Buckler – Senior V.P.
M. Eden – marketing mgr. Plastic optics manufacturing
W. Plummer – head of optical Design

ב"ה
PLEASE NOTE:
This is an incomplete draft
and does not yet have full
rabbinical approval.
TORAH
AND THE
TALIBAN
OPIUM POPPY GROWING IN AFGHANISTAN
IN THE SUPPOSED "FAILED AND PUPPET STATE" OF THE TALIBAN
SHOWING 99% REDUCTION, SPRING 2000, LEFT, SPRING 2001, RIGHT [SEE PAGE 12]
LEADING EXPERTS AND READERS SAID
כָּל הַכָּבוֹד A.
EXTREMELY ENCOURAGING B.
I WOULD LIKE TO SALUTE HIM...
VERY DEEP AND EMPATHETIC UNDERSTANDING C.
THIS BOOK WILL HELP TO END THE WAR SOONER D.
GRATEFUL FOR THIS IMPORTANT INFORMATION E.
A GREAT WORK, WELL RESEARCHED
AND WELL WRITTEN F.
ABSOLUTELY FASCINATING G.
VERY INTERESTING H.
YOUR BOOK REMOVED THE SCALES FROM MY EYES I.
A. SPOZHMAI MAIWANDI, VOICE OF AMERICA B. BERNARD FRAHI, UN, C. PROF. BARNETT RUBIN, LEADING U. S. EXPERT D. A WELL RESPECTED RABBI E. REV. PROF. HARVEY COX, HARVARD THEOLOGIAN F. ABID ULLA JAN, AUTHOR G. H.U. STUDENT H. NOBELIST I. WORLD RENOWNED RABBI-SCHOLAR-PROFESSOR
FOR DETAILED SOURCES FOR THESE QUOTES, & OTHER RESPONSES COVERING THE RANGE FROM EXTREMELY POSITIVE TO THE OPPOSITE, SEE CH. 30 & 31 & APPEND. 1
BY
A.S. Adler
SEE
ABOUT THE AUTHOR
BACK PAGE
shutterstock · 724750
SPEAKING OUT IN UNION SQUARE,
NEAR 14TH ST. NYC, SUMMER '05
5781
EXPANDED FROM CHAPTER 7 OF
ובלכתך בדרך
'AS THOU GOEST BY THE WAY'
THE AUTHOR CAN BE CONTACTED AT
avshadler@yahoo.com
A. ENEMIES OF THE TALIBAN CONTROLLED THIS PROVINCE -BADAKHSHAN- & INCREASED OPIUM POPPY GROWING BY 158% FROM 2000 to 2001-- BECOMING ALLIES OF THE US AFTER 9/11/01. B. OPIUM WAS STORED ON THIS PROVINCE'S BORDER – ENOUGH TO SUPPLY US & EUROPE FOR ~3 YRS. SEE P. 38. C. IF THE SCALE HADN'T BEEN CHANGED BY THE UN MAPPERS BETWEEN THE 2000 & 2001 REPORTS, THERE WOULD HAVE BEEN 3 LARGE RED DOTS IN THIS PROVINCE. INSTEAD OF THE 2 SHOWN. SEE FIGURES 1 & 2 ON P. 12 & DISTRICT DATA, P. 104 & 111. D. THESE ARE OFFICIAL UNITED NATIONS [UNDCP] MAPS WITH NOTES ADDED BY THE AUTHOR, A.S. ADLER. SEE P. 12 FOR LINKS TO THE ORIGINAL UN PUBLICATIONS. E. DOSTOM'S FORMER 'KINGDOM' WHEN HE WAS SOVIET/RUSSIAN ALLY; VANQUISHED BY TALIBAN IN '98; FROM 10/'01, ALLY OF THE US & ENEMY OF THE TALIBAN. F. POPPY GROWING RELOCATIONS. SEE NOTE C, PAGE 14. G. TALIBAN CONTROLLED FROM 1995: 100% DROP IN POPPY GROWING. H. THIS AREA, INCLUDING NANGARHAR & 6 OTHER PROVINCES, SHOWED A 98.4% DROP – BUT, AS A RESULT OF THE CHANGE OF SCALE USED BY THE UN MAPPERS, IT LOOKS LIKE THE TALIBAN LEFT A LOT GROWING HERE. [SEE FIG. 1 & 2 ON P. 12 & FOOTNOTE 30B, P. 13] I. THESE TWO SPOTS HAVE ONE HECTARE EACH.

ב"ה
אומרים שבעים
PLEASE NOTE THAT THIS SEFER IS NOT YET COMPLETE AND DOES NOT YET HAVE FULL RABBINICAL APPROVAL.
שהתכלת דומה לים
והים דומה לעשבים
ועשבים דומין לרקיע
ורקיע דומה לכסא הכבוד
והכסא דומה לספיר
SEE P. 83-4 & P. 39
ספר
אומרים שבעים
"THEY SAY SEVENTY"
'70'
CHIDUSHEI TORAH
on
CHUMASH AND PERKEI AVOS
by
AVROHAM SHLEMA
ADLER
ARRANGED BY PARSHA
WITH A NOVEL SYSTEM OF
TORAH GATEWAYS
TO AND FROM
THE STUDY OF
THE SIX WISDOMS
OF THE MATERIAL WORLD
22 IYAR, 5781
Yerushalayim ir HaKodesh
244 pages
~228k words
TCHELIS IN TIBERIAS
HERB COVERED HILL IS BETWEEN GREEN ARROWS. SEE SEEING WHAT SEEMS MISSING P.83-4
For information about this sefer, the author or the author's four other s'forim cited in this work:
אות הוא לעלם A SIGN FOREVER : How A Mother And Son Became Shomer Shabbos In The Modern World;
ובלכתך בדרך AS THOU GOEST BY THE WAY: Applying Torah in Public Life:Transportation, Education, Energy, Communications, Housing, Public Safety, Sanitation and Peace in Israel; TORAH AND THE TALIBAN: A Closer Look at the Pre-9/11 Taliban Based On Torah Law & Objective Data, 288 p, 278K+ words & ~1K footnotes;
HOW NOT TO GET MYOPIA: A PILOT STUDY OF 'BRISK' STUDENTS IN JERUSALEM, 43p., 24Kwords, ~100 refs.
please email: avshadler@yahoo.com

CONCERN FOR PEOPLE, ASKING QUESTIONS
AND
APPARENT CONTRADICTIONS

The covers of the two books shown here appear, at first glance, to have nothing to do with the subject of this report –preventing myopia related disease. However, these books are deeply tied to the same thought process that led me to carry out the myopia study.

Shortly after the 9/11 attacks, I recognized two sets of apparent contradictions in the media story of the Taliban in Afghanistan. With both sets of contradictions, the version we were hearing after 9/11 made the Taliban look demonic; the "before" version made them look benign. On the basis of the demonic image, the US was gearing up to attack and kill them. I knew, from the war in Vietnam 3 decades before, that the US made big mistakes that resulted in millions of killed. What was the reality now? The apparent contradiction everyone should've seen is the subject of the two official maps on the cover of the book. Before 9/11, we heard the Taliban wiped out opium from one year to the next. After 9/11, we were told they were a failed and puppet state, beholden to Osama ben Laden for support. It appeared to me that if they'd actually wiped out opium, they were in charge -- not beholden to outsiders. I thought that I'd take a few minutes to check this out – and went to the website of the US Drug Enforcement Administration. There was no reason to believe the USDEA would lie to make the Taliban look good. It showed the Taliban had cut opium poppy growing in the country by 91% from 2000 to 2001. [98.7% in Taliban controlled areas.] The supposed failed state had wiped out 2/3 of the illegal opium grown in the world – with a street value of $50 billion. Further checks showed they did it without executions, maiming's or floggings – and that their overall rate of judicial executions per capita per year was extremely low compared with Saudi Arabia. Further checks showed that almost every bad thing said about them was easily shown to be false. What was particularly alarming was that the world's leading expert on the Taliban – Ahmed Rashid [whose Yale University Press book, "Taliban…" sold millions of copies] – was a world leading Taliban demonizer – from well before the 9/11 attacks[281]. My book is said to have helped President Trump negotiate with the Taliban and withdraw US troops.

The second book – of novel but kosher interpretations of the Bible-- may appear to have even less to do with myopia than the book on the Taliban. It began with a question and some apparent contradictions: One of the well-known sections of Proverbs – that religious Jews recite before their first meal on the Sabbath – has the expression "She does him good… ". But the Hebrew word for "does" is not what one might expect. The word has the same root as the Hebrew word for camel! Why is that? I looked into and found that there are several other words that are related to camel – including weaning a baby, ripening fruit and acts of kindness! What is the connection? When a camel tanks-up, it can drink 20% of its body weight in water. It fills itself up so that it can go in the desert and support itself and others. So "camel kindness" is an act of kindness that enables the recipient to go into a "desert" and not only support themselves but support – and do acts of similar kindness - for others. …

The book ended with another apparent contradiction, and another question – that led to the study of the causes of myopia. I saw a photo of "Mt. Ararat "– taken from a plane in mid-summer. The upper half of the mountain is quite steep- with the top .8km even steeper and covered with ice and snow. I wondered why I never heard stories from Jewish Tradition of Noah having difficulties –or open miracles - getting down from that mountain? I looked into it and found that "Mt. Ararat" isn't from Jewish Tradition and the Torah doesn't say that the ark landed on the top of any mountain! I wrote what amounts to a whole book on some of what Jewish Tradition has to say about the Flood. When I thought I had finished this piece – and the entire book, I brought this to the attention of a well-known rabbi in NYC and he said to me: *מאי נפקא מינה ? ("What's the practical difference?")* I found that understanding "which mountain" and what the Torah and our sages of the Talmud actually said, provides a better way to reconcile the Biblical account with the discoverable evidence – while ignoring both leads to some combination of denial and confusion.

At the same time, I thought of the name of the book suggested to me over a decade before *"…I will lift up my eyes to the mountains…"* This reminded me of what my grandmother had told me - only once- when I was three – to lift up my eyes from the page … and I began to research the scientific literature to see if she was right. [See dedication, last page.]

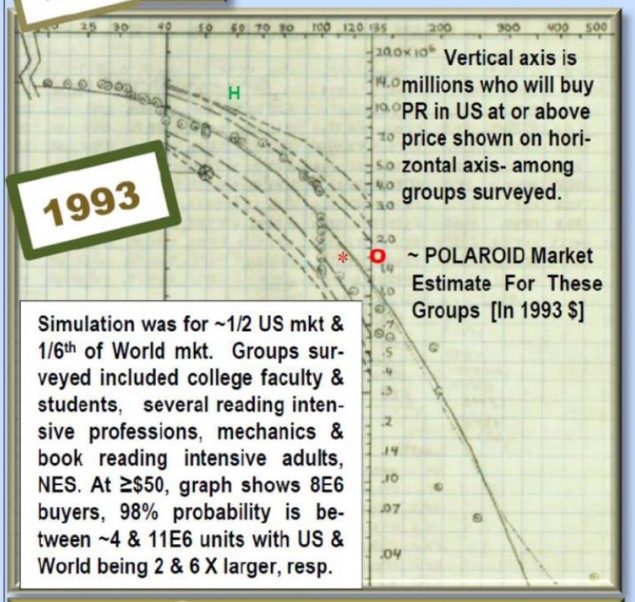
[281] Rashid was in 3rd place on the credits—as the consultant -- of the pre9/11, made for TV, documentary, "Beneath the Veil". Its centerpiece is the execution of a woman in the Kabul stadium under the Taliban. It doesn't say what she was executed for & implies this was routine under the Taliban – where women were supposedly executed for nothing significant, before crowds "baying for the blood" of other human beings. This work was reportedly shown in 40 countries around the clock after 9/11 – & won multiple prestigious awards. What experts & journalists familiar with the Taliban knew, was only 1 woman was executed in Kabul under the Taliban-for beating her husband to death with hammer as he slept & the crowd was silent as they listened to a long discourse on why there is capital punishment in Islam, what the woman was accused of & a description of the three levels of judicial review.

The Personal Reader™ [PR] ב"ה

A.S. Adler, Personal Reader Project, Jerusalem

SID Wearable and Projection Displays, 13-14/3/'17, Dresden

A.1983. Edwin Land Recommends Personal Reader For POLAROID [1]

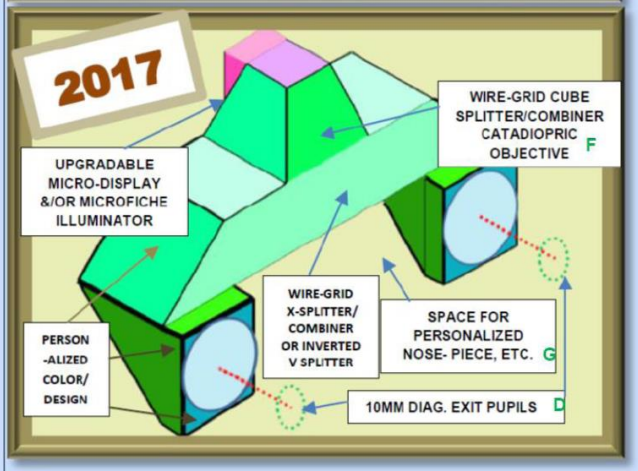

1993
Vertical axis is millions who will buy PR in US at or above price shown on horizontal axis- among groups surveyed.
~ POLAROID Market Estimate For These Groups [In 1993 $]
Simulation was for ~1/2 US mkt & 1/6th of World mkt. Groups surveyed included college faculty & students, several reading intensive professions, mechanics & book reading intensive adults, NES. At ≥$50, graph shows 8E6 buyers, 98% probability is between ~4 & 11E6 units with US & World being 2 & 6 X larger, resp.

B.1993. World Market 50 Million PR's:

Monte-Carlo simulation showed 30-60E6 buyers for 150 gm, microfiche-only PR, @$50 consumer price [1992-3].[2]

C.2017. New Microdisplays,[A]

milliwatt light sources, wire grid polarizers & other technologies, make possible a 70gm,[B] shirt-pocket-size PR & projected Global Market ≥$5 billion.[E]


2017
WIRE-GRID CUBE SPLITTER/COMBINER CATADIOPRIC OBJECTIVE F
UPGRADABLE MICRO-DISPLAY &/OR MICROFICHE ILLUMINATOR
WIRE-GRID X-SPLITTER/ COMBINER OR INVERTED V SPLITTER
SPACE FOR PERSONALIZED NOSE- PIECE, ETC. G
PERSON -ALIZED COLOR/ DESIGN
10MM DIAG. EXIT PUPILS D

D. THE FUTURE: Reading with both hands free, eyes relaxed[3],

inside a sleeping bag, without disturbing others or 'off the grid'[4]. Special benefit to growing numbers of older readers[5], survivalists & the military. Unlike other eBook readers, it can be used on the Sabbath by religious Jews[6]. With only one micro-display for bi-ocular viewing, it's readily upgradable as better micro-displays come on-stream.[7] More pleasure from reading? The image moving exactly with the head may create the reverse of motion sickness[8].

We call it The Virtual Swing™.

NOTES: 1. Based on: Report of progress to date on investigation concerning the practicability of a wearable biocular microscope for microfiche reading. David S. Grey, Prep. for S. Adler, 4/28/'83, 8 p.+ attachments. Dr. Grey wrote: "By using...Adler's design criteria,...to my knowledge, never before employed in compound microscopes, ...a relatively simple, compact, light-weight and wearable micro-reader system could be arrived at without using ingenuity beyond the state of the lens design art." Prof. Land, Z"L,[1909-91], who'd retired from the company he founded but still owned the largest block of stock, also saw Polaroid as tops in plastic optics & instant microfilm. Polaroid's Dir. of Optical Eng., Dr. W. T. Plummer, said biocular alignment issues would need special attention. Still, Polaroid said they could make & sell 10E6, 5oz.*, microfiche-only devices – with shipments of $0.5E9 [1983]. **2.** Simulation was based on 96+ in-person interviews. Subjects were shown a larger version of the picture at upper left & encouraged to try a monocular fiche reader. Assumed log-normal underlying price distrib. Prepared for JCT. **3.** Reading an apparently distant but suitably sized virtual page should greatly reduce myopic tendency of reading intensive people. **4.** ~.8E9 people will probably be off the grid in 2030 [IEA] with~1-3% book-reading-intensives. **5.** 70yr olds need ~10x image brightness as 20 yr. olds for the same quality reading experience. With PR, it's easy to have very bright images without big lamps. ≥10% are ≥70 yrs. **6.** For reading microfiche – which involves no traditionally forbidden 'work'. A small LED can be turned on before the Sabbath & the switch covered. In a bright room or daylight, no internal light is needed to read fiche. As the fiche being read is attached to the PR, it prevents the appearance of doing something forbidden on the Sabbath. **7.** Versions employing polarizing wire-grid beamsplitter/combiners can be adopted for stereo. **8.** The ~35° diagonal,[C] page-size image moves against a real world background with temporal & lower 3rds of visual field unobstructed. Extent & intensity of VS effect aren't yet known, but recent study by D. Whittinghill, et al, suggests it's both prevalent & significant: Game Developers Conf., San Fran., Mar 2-6/'15; Purdue U. 3/ 24/15.

TM: A. S. Adler, avshadler@yahoo.com, Mar. 7/'17

[A] Like in Epson's Moverio BT-300. [B] At 8/20, PR ~50gm. [C] 28° diag.F.O.V. & [D] 8 mm exit pupils. New specs based on ~.5m normative reading distance when looking forward when document isn't hand held. See p.141, note J7b. [E] Market estim.≥$25 Billion. See p141, Line 11. [F] Catadioptric objective is on top for fiche reading but between eyes for more compact non-fiche designs. [G] Special, full field, prescription lenses, incl. bifocals, can be designed to slide into & out of this space. [H] Dashed lines in 1993 fig. show probabilities for individual prices, not complete price distributions. If, e.g., actual number of buyers at ≥$135 is substantially higher than solid middle curve, it will likely be closer to or even lower than solid middle curve at ≥$40. Top curve at H results from deficient sampling. * Polaroid study was for 200gm system for sustained reading of standard 24× fiche & ~60× microbooks™ & quick-look-up ~90× ultrafiche. For simpler, 24×, 150g system, price would be ~$113[1993 $]

PERSONAL READER™ ב"ה

INTUITIVE MARKET STUDY FOR "50 GRAM" DESIGNS[A] MAY 26/'21 [16 SIVAN, 5781]

[ONE PAGE, NON-CONFIDENTIAL VERSION]

TM. A. S. ADLER, PERSONAL READER PROJECT, JERUSALEM

	A	B	C	D	E	F	G	H= F×G	I	J[B] ONE OBJECTIVE, BI-OCULAR % COL. F&H	J UNITS [10^6]	J $ [10^9]	K MICROFICHE[E] % COL. F&H	K UNITS [10^6]	K $ [10^9]	L RUGGED[F] % COL. F&H	L UNITS [10^6]	L $ [10^9]
	MARKET GROUP [MILLION [10^6] PEOPLE]	# in USA	% B IN GRP A	% C BUY-ING	D×C ×B USA	E×7.0[C]= TOTAL WORLD BUYERS	PRICE PER UNIT: $ RETAIL[D]	**WORLD SALES: 10^9**	**COMMENTS SEE ALSO NOTES BELOW**									
1	MECHANICS & FIELD SERVICE TECHNICIANS	6.2[G]	100	[73]	4.5	31.6	[106]	3.35	READ DIAGRAMS WHILE WORKING WITH HANDS FREE[H] COMPETITION FROM OTHER AUGM. REALITY.	2%	0.62	0.067	2%[I]	0.62	0.067	5%[J]	1.58	0.502
1.1	BOOK READING INTENSIVE[K]	*1.55*	*100*	*90*	*1.4*	*9.8*	120	*1.17*	READ ≥12 BOOKS /YEAR[L] [CAN OWN BOTH PR & OTHER AUGMENTED REALITY DEVICES]									
1.2	NOT BOOK READING INTENSIVE.	*4.65*	*100*	*67*	*3.1*	*21.8*	100	*2.18*	MAY ALSO READ NEWSPAPERS/MAGAZINES + A FEW BOOKS [CAN OWN BOTH PR & AUG. REALITY DEVICES]									
2	BOOK READING INTENIVE,[M] ≥18YRS, OTHER THAN LINE 1.1	47.4							READ 12 OR MORE BOOKS /YR[L], AVG ~20 BOOKS/YR									
2.1	WANT VERY BRIGHT, LOW GLARE LIGHT TO READ[N]		18	70	6.0	41.8	80	3.34	ASSUMES NONE IN LINE 1. BRIGHT LIGHT+ AGE MAKES SMALLER PUPIL & SMALLER PR OPTICS	70[O]	29.26	2.338	2[G, I]	0.84	0.067	5[P]	2.09	0.501
2.1 a	≥70Y [& GREATER DISTANCE & LESS GLARE FROM AMBIENT LIGHT]		10	70					≥70 NEED/WANT ~10×LIGHT OF AVG. 20Y OLD FOR SIMILAR R QUALITY.									
2.1 b	LESS THAN 70 YEARS OLD		9	70					9% ≥18<70"""WANT 300 LUMENS/FT^{2}·~1K NITS, COMP. TO 30 LUMENS/FT^{2}~100NITS									
2.2	READ WITH BOTH HANDS FREE [EATING, KNITTING, TYPING, ETC.]	41.4[Q]	20	70	5.8	40.6	80	3.25	20%=INTUITIVE, NON-DUPLICATIVE ∑ SUBGROUPS [INCL. READ WHILE LYING ON BACK]	2[I]	0.81	0.065	2[G]	0.81	0.065	10[P]	4.06	0.975
2.3	READ WITHOUT LIGHT THAT DISTURBS OTHERS+PRIVACY	35.6[R]	20	70	5.0	34.9	70	2.44	20% = INTUITIVE, NON-DUPLICATIVE ∑ OF SUB-GROUPS. MAKES SMALL HOMES MORE LIVABLE	2[I]	0.70	0.049	2[G]	0.70	0.049	1[P]	0.35	0.073
2.4	READ IN CROWDED METRO/BUS – NO SPACE FOR BOOK/PHONE	30.6[S]	.5	70	0.1	[×30=]3.2	60	0.19	×30 BASED ON # IN JAPAN, CHINA, INDIA, S. AMERICA & EGYPT. MAKES MASS TRANSIT MORE ATTRACTIVE.	1	0.03	0.002	1	0.03	0.002	3[P]	0.10	0.017
2.6	LOW VISION	30.5[T]	2	70	0.4	3.0	80	0.24	FACTOR OF 7 IS A GUESS, GET BETTER DATA	1	0.03	0.002	1	0.03	0.002	10[P]	0.30	0.072
1+2	**SUBTOTAL**	NA	NA	NA	21.8[U]	**155.1**	**[83]**	**12.81**	COLUMN G BASED ON ∑ FOR SUBTOTAL		31.45	2.523		3.03	0.252		8.48	2.140
3.	ANTI-OBSOLESCENT / SURVIVALIST[V]	222.2	1	70	1.6	10.9	100	1.09	WANT MICROFICHE –GUESS – MAY BE MUCH HIGHER. [1/4 RUGGED]	100	10.90	1.090	100	10.90	1.090	25	2.72	0.812
4.	ANTI-VISUAL STRESS & DYSLEXIA/ EYE TRACKING[W]	220.6	1	70	1.5	10.8	80	0.86	REDUCED PATTERN GLARE/IMPROVED READING. NEEDS 1 MD PR. [PLACE HOLDER]	100	10.80	0.860	1	0.11	0.009	1[P]	0.11	0.026
5.1	READ 'OFF THE GRID': 1.2E9 PEOPLE, 4% BOOK READERS[X]	NA	NA	NA	NA	41.0	30	1.23	LITERATE SHEPHERDS, DISTANCE EDUCATION, INCLUDING CHILDREN	30	12.30	0.369	30	12.30	0.369	10	4.10	0.369
5.2	BACK-PACKING TOURISTS	NA	NA	NA	NA	28.6	80	2.29	MOSTLY YOUNG, EARLY ADOPTERS. INCLUDES WILDERNESS HIKERS & CAMPERS	30	8.58	0.687	30[Y]	8.58	0.687	20	5.72	1.374
6.	SHOMER SHABBES—INCL. CHILDREN[Z]					1.1	80	0.09	WANT MICROFICHE [TOT. 1.5 MILLION SABBATH OBERVING JEWS WANT MF, .6E6 INCL. ABOVE & BELOW.]	100	1.10	0.090	100	1.10	0.090	5[P,J]	0.06	0.014
7	**TOTAL, LESS SPECULATIVE**					**247.5**	**[74]**	**18.37**	~1/6TH OF YEARLY SMART PHONE SALES IN 2020.		75.13	5.619		36.02	2.497		21.19	4.735
8.1	MYOPIA CONTROL—CHILDREN 7-17 YRS OLD[EE]					26.2	80	2.10	FAST POP. GROWTH+GROWING % IN SCHOOL [PREVENT OVER 1E6 BLIND FROM MYOPIC-MACULAPTHY]	20[AA]	5.24	0.420	20[Y]	5.24	0.420	10[P,J]	2.62	0.630
8.2	MYOPIA CONTROL, ADULTS[EE]	29.6	.6×.5=30	40	3.6	[×10=]35.6	100	3.56	[×10 BASED ON TERT. EDUCAT'N. VERY HIGH RATE IN CHIN, JAP, KOR] ~NO DOUBLE COUNTING FROM LINE 7	2[I]	0.71	0.071	2[I]	0.71	0.071	10[P,J]	3.56	1.068
9.	VIRTUAL SWING [™A.S. ADLER]	26.0[BB]	5	60	0.8	5.5	80	0.44	REVERSE OF MOTION SICKNESS [NOT YET SURVEYED]	2[I]	0.11	0.009	2[I]	0.11	0.009	10[P,J]	0.55	0.132
10.	TABLET & E-BOOK READER MKT, [NES][CC]	25.2	10[DD]	60	1.5	10.6	80	0.85	DIFFICULT TO QUANTIFY. LIKELY MUCH HIGHER	2[I]	0.21	0.017	2[I]	0.21	0.017	10[P,J]	1.06	0.255
11.	TOTAL, INCL. SPECULATIVE					**325.4**	**[$78]**	**$25.32**	NOT INCLUDING FUTURE GROWTH	[$83]	81.40	6.777	[$71]	42.29	3.014	[$235]	28.98	6.820
12	**TOTAL GLOBAL SALES, INCLUDING RUGGED**					**325.4**	**[$92]**	**~$30.00**	(~25.32+(2/3×6.82 [RUGGED: COLUMN L$]))		81.40, 6.777 [PART OF TOTAL]			42.29, 3.014 [PART OF "ONE OBJECTIVE"]				
13	**PHOTO VIEWING**							$10.00?	FAMILY, ART, NATURE: HDR, WIDE GAMUT– TRANSPARENCIES. LITTLE INTEREST IN READING OR MECHANICAL TRADES.		$2.00?			$1.00?				
14	**ADD-ONS, UPGRADES, BACKUP DEVICE & FICHE BOOKS**							$10.00?	SUCH TRANSPARENT BOOKS & PHOTOS COULD BE MICRO-INKJET PRINTED WITH A WIDE GAMUT HDR, 8MM PRINTHEAD.		$2.00?			$1.00?				
15	**GRAND TOTAL**						**$50 [BILLION]**		NOT INCLUDING BENEFITS OF REDUCED BLINDNESS, VISION IMPAIRMENT, NEED FOR GLASSES & CO2[EE,FF]		**$11[BILLION]**			**$5 [BILLION]**				
16	**RETAIL SALES OVER LIFE OF PATENTS**						**$100 [BILLION][EE]**		IN 15+ YEARS, WORLD MARKET EXPANDS WITH HIGHER INCOME & EDUCATION & OLD DEVICES ARE REPLACED[FF]		**$20[BILLION]**			**$10 [BILLION]**				
17	**" " " OPHTHALMIC LENSES TO PR MKT**						**>$150 [BILLION]**		OPHTHALMIC LENSES OPTIMIZED FOR PR, PRESCRIBED & DISPENSED WITH EYE EXAM FROM PR SALES KIOSK[GG]		**$30[BILLION]**			**$15 [BILLION]**				

ABBREVIATIONS: A.R.: Augmented Reality; b: book/bed; BR: b read/ing/er; C: CO2e; d: diam/diag/dist/day; DVB: Distance Viewing Breaks E: Electronic/s, energy, eye; E6: million/s; E9: billion; ep: exit pupil; ipd: interpupillary dist.; LCA: Life Cycle Assessment; m: month, myopia; md: micro-display; mf: microfiche; MMD: Myopic Macular Degeneration; mt: metric ton; O: Optics; p: pupil; PH: Place Holder; PR: Personal Reader; prod: produced/ production; R/r: read/er/ing; s: systems; Soc.Ben: Social Benefits; sp: subpixel; T.E.: Tertiary Educat'n; u: unit/s; w: with/watt/week; W: world; wt: weight; w/o: without; y: year

[A] Table based on: 1. A.S.Adler's 150g, single mag. Personal Interview Survey ['93]: 1/3 buy ≥50$;1/2 don't buy at <$28: shows "form factor resistance" due to weight, bulk, appearance & difficulty putting it on, etc. 2. "50gm" worn-like-glasses-design, reduces "form factor resistance." 3. The official military market is not considered here, but many in the military may want a Personal Reader to study/ read for leisure in crowded, "lights out" barracks, shipboard or field-camp conditions.

[B] All 'single display', '1 objective' & ' 'fiche' versions listed here & large fraction of 2 objective versions, use proprietary PR™ design systm.

[C] World/US printing & writing paper consumption~*6.10 estim '17;* W/US Tertiary Enroll.~11.51 estim '17; Use 7.0 for W mkt Factor [Col F.] 10 for Adult m, NES; 30 for crowded transit. Assumes 1 device/user, but, like glasses, some may buy 1 for "backup".

[D] Retail Price:10E6u/y rate. Initially>2X higher. 2021 price & function limiter is high image quality, color, micro-display.

[E] All devices for microfiche are assumed to be "one objective" biocular, proprietary, Personal Reader design.

[F] Rugged: designed to be banged around, water proof & available in both proprietary & non-proprietary Personal Reader versions.

[G] Based on US, Occupational Outlook Handb'k, expected growth 2014-24, so 6.2 E6 in 2017. + many work part time or– hobbyists.

[H] PR's + light & camera: illum. work & relay image to remote instructors &/or superimpose diagrams on md; cameras: incl. wide angle & telephoto/magnifier; 2 nosepieces?-for mechanical work & Book Reading.

[I] Want option to read E9 legacy microfiche- not survivalists.

[J] 1. Want rugged device for shop-& have extra money. 2. 5% for 3×price, based on Adler '93 study[A.1] – between main price -- $40 & ~$120 -- demand drops by factor of 6.3. 3. ~$80 in Col. G, isn't saturation price – or highest volume production price – both ~ 1/2 that. 4. Top 10% of US homes have ~5X income of median home. Mechanics, technicians & older people have lower avg income; Shomer Shabbos Jews have large families – and less per-capita.

[K] From 1993 Personal Interview Survey.

[L] Somewhat arbitrary: sustained reading time is better indicator.

[M] 23.5% US≥18y r≥12[avg~30] b/y whole or part, incl. e. b's & audio b's. p16, 'BR 2016',Pew Res. 9/1,'16. 325E6*.75=244E6≥18;[~Pew '19] ~20% is target r intens, mkt. 48.8E6; -1.4E6[from 1.1E]=47.4,US[%2018~'16] See also:'Reading & Buying B's… '05' Nat'n'l Survey Final Rpt .Canada

[N] 1. 'Healthy Aging Impairs Photon Absrpt'n Efficncy of Cones', D.Silvestre+, Invest. Oph., Vis Sci.'19,544–51.~10X, 26.5y-75.9y, norml acuity; 'Visual perf…for 156 normal obsrvrs of various ages''71, J.Illum. Eng.Soc.v.1,p.3-13;'Indiv. resp. to lighting parameters for…235 observers of various ages' J.I.E.S,10,205-32 '80;IES Lighting Hndbk '81. Blackwell. 2. PR:high brightness[w/o big light]& low glare:'Glare…[causes] disprop. age-related decr. in visual function…' Human Factors & Aging: Identify…Age-related Deficits in Sens…Funct'n',F.Schieber, U.S.Dak

[O] 1 md ~2× efficient for light use & upgraded &/or replaced at ~1/2 cost. 30% want stereo & aren't concerned about cost difference.

[P] Have extra money and want rugged system.

[Q] [Minus buyers at 2.1col.E.]Incl: 1. R+Eat, 2. R+Type. 3. R+Knit/Croch 4. R+Holding Baby. 6. R+Unable To Hold B [medical diffic. w hands, gen'l weakness] 7. R+lying on back[~8%] [Maybe also anti-m.]Table 2,'Assoc…of r posture, gaze angle & r d. w m & m progr.', O. Paarssinen+ Acta Ophth.'16,94:775–9]

[R] Minus buyers at 2.2col.E, . INCL.:1. Those Sharing Bed/Room 2. Sick in Hosp. 3. Soldiers Barracks/Night Missions 4. Confidential r. 5. 1/5 Adults 18-91y r print in bed, bedtime, 7d/w;18%1-6d/w;oldest 2x youngest[Norway]'Age & sex differences in bedroom" '17, B. Bjorvatn 6. R in dark w/o PR, prevents DVB & is myopogenic. EE.2

[S] Buyers from line 2.3E, subtracted.

[T] Buyers from line 2.4E, subtracted

[U] 21.8 assumes 2.1, 2.2 , 2.3 & 2.4 aren't correlated].

[V] [M]244E6-21.8E6=222.2E6; N.2 222.2-1.6;

[W] Eye tracking may also be used– instead of a keyboard or touch pad-both as assistive tech. & hands-free connection, with/without voice.

[X] 1.2E9 people off the grid [IEA,W Energy Outlook'16,p.4]Subtr 21.8,n.U)from 47.4(n.M)=25.6;×1%×70%=0.179; ×2=0.36)=USA BR intensive incl. in lines 3&4; 21.8+0.4=22.2; 22.2/[47.4+[1.4[line1.1E]]=48.8] =45.5% of W BRs already incl. w standard W factor 7. So 45.5% of assumed 4% 'off the grid BR intensives'≥18 already incl..54.5% of 4%=2.2%; ~2/3 of 1.2E9≥18y; 0.022×.8E9=17.6E6.As only 70% buy –[too poor]=12.3E6; [% adults buying: 1. 1 color disp/fam; 2. >100E6 u prod., price drop. 3. Tablet costs more; 4. Can buy used PR's & md's. 5. Advert. supported] Assume another 2% of adults in Dist. Educ. but not "heavy r's"[.02* .8E9]=16E6. Assume 10% of children of reading age <18 are either heavy BRs or in Distance Educ.; 0.10× .25E9= 25E6;25+16= 41E6; Assume 70%buy=28.7E6 u+ 12.3E6 from initial BR intensive group= 41E6.

[Y] Incl. possib. microscope attachm'nt: study insects, cells, plankton…

[Z] Globally, ~4 million Jews identify as Traditional-Sabbath Observant

[AA] high efficiency mono-objective version -runs 2x longer/charge.

[BB.1] =29.6-3.6[from line 8.2]=26.0. Just BR's.

[CC] [25.2=26.0-0.8 from line 9]Direct compet. PR vs Clamshell, Tablet, E-Book Readers & smart phones—in addition to features in items above.

[DD] PH: Will include many who aren't BR intensive. [Very conservative]

[EE] Globally, in 2021-'31 ~15-60K people will go blind from MMD/ month. By 2050, 10-30E6 will be blind from MMD & 20-60E6 more, will have Vision Impairment from MMD- if nothing is done to stop it. T. R Fricke, et al:"The Global Preval. of V.I. Assoc with MMD. and Temporal Trends From 2000 Through 2050…" Br.J. Ophth, '18; 102: p.855–62.

1. If PR prevents 10%: 2E6 w/o MMD blindness & 4E6 w/o MMD V.I. – benefits >$500E9 & scores of millions wouldn't need another >$500E9 for multiple changes of glasses, etc., Y-F. Zheng, et al: "The Economic Cost of Myopia in Adults Aged Over 40 Yrs in Singap."Inv.Oph.Vis.Sci., '13;S-M Saw, et al,"Utility Values & Myopia In Teen[…s]" Brit.J.Oph. '03. 2. Myopia, MMD & its more damaging sequalae can be reduced with DVB: "The Association Between Habitual, Short, Distance Viewing Breaks During Reading & The Advancement of Myopia In Read-ing Intensive, College-Age Men" A.S.Adler,Apr.8/'21. Undertaken after seeing the size of the myopia problem in this market research study.

[FF] 1. PR users r avg.>10A4'60lb' sheets/h; 500h/y. ~26kg/y [incl. covers, indexes,[M] [+some non-b]; ~2.2kgC/kg[Pihkola]+.5Eu grid]+.1[b store]+1[home,10y]+1[biogen C in prodctn & forest resid [~¼ actual]]+.2 machine constr.?] +1 disposal? [incin./landfill?]=6kgC/kg b; based on: 'Carbon Footprint of Print…'H.Pihkola,et al,'10 & B.Holtsmark; GCB Bioenergy,'15-7.]:6×26=156kg C/y saved/PR ×400E6 PRs×15y= 936 E6mt C:×$100/mt['Social Cost of C…',Stern&StiglitzWP#28472, NBER, 2/'21= $94E9 for paper→PR. 2. Same R on Huawei: Product Envir Info: touch screens:Y7'19 6.25" smart-phone,168g;10.8"tablet MediaPadM5,'18, 504g, 63&159kgC/2y life. If ½ for R &½phn, ½tblt=[63+159]= 222kg/4= 55.5kg/y;/2=28kg/y R. Assume 3y life=20kg/y R. 3. PR's C footprint: mfg ~1/3 smart ph; 5y life of electronics; ~7+y life of optics; 'solar' power: [60/3]×[3/5]=12kg/PR/ y×400E6PR's [avg/y]=4.8E9kg/y;×15y=72E6mt; $100/mt=$7.2E9 4.[[tblt or phone] to PR=20kg/y× 4E8×15y×$100/mt= $12E9;½ from ea.[94+12]/2=$53E9 5. Net C savings $53E9[paper, smrt phone & tablet]-7E9[PR] =$46E9. 6. Dedicated e-readers: less C/device but 100% for r. Not using tablet or smart phone to r extends its life but may also make one or both redundant. 7. PR maker can offset C of, e.g., computer printers – with these C savings. Maybe also anti-myopia "Health Offset"? 8. By 2050, all of the systems may be C neutral.

[GG] Ophthalmic lenses designed for PR: no 2nd temples, lower size, wt & cost, promotes remote ophthalmic exam. Contact lenses allow further reduction of size, wt. & cost of PR. Best is not needing glasses at all -- including, as result of DVB program [noted at EE.2, supra].

ב"ה

May this study bring benefit to all of us -- here, in Jerusalem and across the World.

8th Night of Chanukah 5780

JERUSALEM

This study is dedicated
To the memory of my Grandmother

CHAYA ROCHEL

[ROSE FUNAROFF]
bas
R. Shlemeh Adler
of Kletzk

who taught me at the age of three to

Lift up my eyes…[205]

אשא

עיני אל-ההרים

"…I will lift up my eyes to the mountains - הרים -; from where will my help come?" **[Ps. 121:1]. The 1st words of this Psalm were suggested as the title for my Sefer Chidushei Torah by a young teenager, Yaakov Shapira, when I first started writing down my chidushim in the late 1990"s, in Bnei Brak, Israel. It begins with the initials of my name:**

...אשא.... [Aleph Shin Aleph]

The word הרים – *horim* –['o' like 'awe'] ordinarily means "mountains" but is closely related to הורים [From הוֹרַי - Gen.49:26]-- with almost the same pronunciation-- *horim*- ['o' like 'oat'] that means "my parents or ancestors".[At [5/13/'21], it appears likely my grandmother originated the idea of "Lift up your eyes from the page every 15 minutes & look out the window..."] [31-A-E]